The AUDIO-VISUAL HANDBOOK

ELLSWORTH C. DENT

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THE
AUDIO-VISUAL HANDBOOK

The

Audio-Visual Handbook

By

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Special appreciation is extended to William F. Kruse, William D. Boutwell, Robert M. Griffin and W. L. Rothenberger for their assistance in preparing this revision.

AUTHOR'S NOTE

THE purpose of this booklet is stated in its title—a handbook of information in convenient arrangement for those who may be interested in applying visual or audio-visual aids to instruction. It is intended for two groups: (1) teachers, supervisors and school executives who desire brief general information concerning visual-sensory aids to learning, as well as a guide to sources of materials and further information; and (2) students in visual or audio-visual instruction courses, whose desires should be much the same.

The booklet is limited in size for one principal reason; to provide a useful manual at moderate cost. It would have been easier to have included more material, rather than choose that which seems to be of greatest service to teachers. The greater part of the material included has been used in visual instruction classes with satisfactory results.

The demand for the first edition of the "Handbook" was greater than was anticipated, exhausting the supply before the second edition was ready for publication. In keeping with the original plan to make frequent revisions, this, the third edition, contains additional information which should be helpful to users of visual-sensory aids to instruction and to those who are interested in the application of audio-visual aids to instruction.

The need for such a source-book is evidenced by the unusually large number of inquiries concerning sources of materials and equipment. Prior to the publication of the first edition, there had been no single publication or small group of publications to which the beginner in the use of visual or audio-visual aids could go for information.

It is not intended that this publication should supplant the available texts in the field of visual instruction. Instead, it should be used to supplement the regular texts and course outlines, many of which cannot be revised so easily.

A survey of common practice among several of the leading school systems indicates an increasing trend toward the greater use of sound and audio-visual aids. It seems, also, that the visual instruction director is expected to direct the use of sound for instructional purposes. Accordingly, the title has been changed to "Audio-Visual" including many types of scientific aids to learning.

E. C. D.

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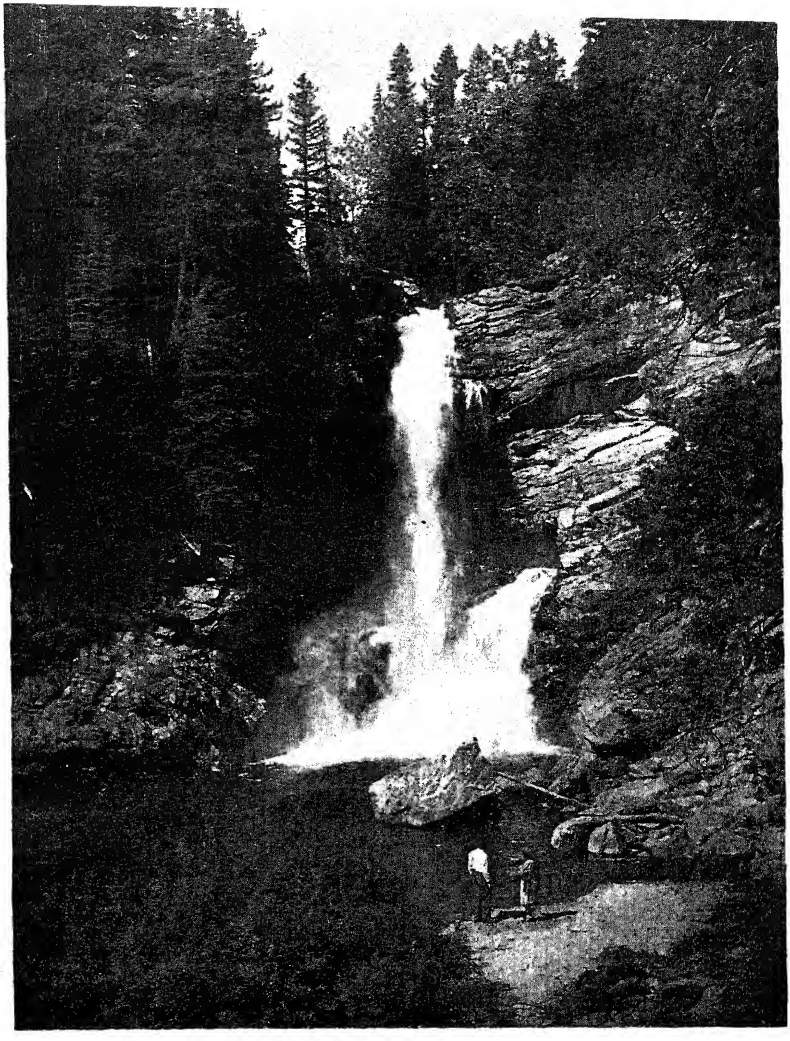

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TRICK FALLS, GLACIER NATIONAL PARK

The Status of Visual Instruction

The Meaning of "Visual Instruction"

THE somewhat frequent misinterpretation of the term, visual instruction, seems to warrant brief consideration of its true meaning. In the evolutionary process of adapting illustrative materials to classroom and other instruction, "visual" instruction seems to be in the second stage. The original designation, "visual education," was partly fitting at a time when the radio and the sound picture were still imaginary. This term has been discarded by many inasmuch as it seems to designate a special field in education, rather than a set of materials and simple rules for their effective use, co-ordinated with all educative activity.

In the early stages of the development of the use of visual aids, it was thought that the eye was all-powerful in the educative process. Some were enthusiastic enough to state that eighty to eighty-five per cent of all we know is learned through the eye. Others surmised that it would not be long until texts would be replaced by pictorial substitutes for the printed word. Later, it was found that some of these speculations were a bit extravagant, if not absurd, and that the other senses are very important in receiving a clear impression of the material to be learned. It was found that the sense of touch aided materially in giving the correct concepts of objects-specimens-models. The sense of smell became important in many situations. In other cases, taste came to the rescue. And the sometimes unadorning ear is being recognized as highly important to learning.

The more sane analysis of the true factors affecting learning has developed another term—"visual-sensory aids"—which seems to be in favor among the leaders in this field. The term is applied to all materials used in the classroom, or in other teaching situations, to facilitate the understanding of the written or spoken word. The most important is the visual, but it will be interlinked with the other senses in such a way that it would be difficult to separate one from the other or to determine the exact contribution of each, separately. In fact, there are few psychologists who would attempt so to control all other factors that the true learning power of each of the senses might be segregated and measured. Perhaps, after all, there is no good reason for becoming unduly concerned over the matter.

It may be sufficient to state that the eye is considered to be primary in importance, thus giving us the right to place it ahead of the other senses. In this situation our term, visual-sensory aids, becomes a more nearly true statement of the situation than would "visual education" or "visual instruction." The development of sound pictures, sound filmslides, radio programs, sound recording, reproducing and distributing equipment, the majority of which are being used extensively among schools, is bringing into use a comparatively new term, "audio-visual." It is used to encompass almost the entire field of illustrative materials; visual aids, sound aids, and the various combinations of the two. Perhaps all might be classified more appropriately under the general term, "Scientific Aids to Learning," as very few can do more than aid the pupil in his acquisition of usuable knowledge.

The discussions which follow will consider the different types of visual aids, with some suggestions concerning the use of such aids. Following, in turn, there will be discussions of sound aids and of audio-visual aids to instruction. The next several pages will be concerned almost entirely with visual aids.

The use of the picture as an aid in education is not new in any sense of the word. For many thousands of years it has been exceedingly important in conveying correct impressions from one to another. Perhaps it was the first substitute for pantomime, or the re-enacting of the event, which became more and more difficult with the increase in the complexity of the social structure and of knowledge. Perhaps its first use was as a warning, carved on the bark of a tree or scratched on the surface of a stone, to tell others of dangers in that vicinity. Regardless of its earliest use, we are reasonably certain that a picture language was the forerunner of our modern alphabet.

As the printed letter or word has become further removed from its ancestor, the picture, it has become more and more abstract; more and more difficult for the human mind to understand fully. A technical discussion of almost any subject before an average group is understood only by those who have had training in that field. The same discussion, presented in the usual language of most of us, might become clear and understandable, particularly if a few pertinent illustrative materials were used. We recognize symbols and think only in terms of past experience. Accordingly, it is imperative that we include in our educational procedure the maximum number

of those things or representations of things which aid in clarifying thought—in making objective the abstract.

One factor which has served to retard the normal development of the use of visual-sensory aids to instruction has been the narrow interpretation of some of the most active workers. Some think of visual instruction as being the use of motion pictures for instructional purposes; others think of the glass slide or filmslide; and still others may think only of the excursion or of museum materials. There are those who argue that the talking or sound motion picture is the acme of perfection in visual instruction. Some have the feeling that the silent picture is more valuable in many situations. Some consider that the glass slide offers more educational advantages than any other type of projected picture. Some will not give the filmslide fair consideration, because of its size, while others find it to be extremely valuable in many situations.

These extreme claims for one type and criticisms of other forms of visual aids have done much to place the novice in a quandary, wondering if there is any true value in any of the materials mentioned. This is an unfortunate situation, and might be eliminated by giving each type fair and careful consideration. The school journey is one of the most effective of all teaching tools, if applied properly. Similarly, the exhibit, the photograph, the stereograph, the glass slide, the filmslide, the sound filmslide, the silent motion picture and the sound motion picture will produce extremely satisfactory results if applied when, where and as they should be applied. Each has its place and there is a place for each in nearly every teaching situation. In certain situations, some will be found to be better than others. Combinations of types are frequently desirable.

Another factor which has tended to retard the more extensive use of visual-sensory aids to instruction has been the over-statement of facts relative to certain findings. If one is in the market for an automobile and an enthusiastic salesman represents his type of car as being twice as speedy; capable of giving twice as much mileage on a gallon of gasoline; twice the mileage on tires; and twice the mileage without repairs or adjustments, as compared with other cars of similar type and price, it is quite probable his veracity would be questioned. The same feeling has developed relative to certain statements issued by those who have become super-enthusiastic about the instructional possibilities of visual-sensory aids.

The late noted scientist, who predicted twenty years ago that we should be able, soon, to throw away our texts, discharge the majority of our teachers, and teach the children in two or three hours each day with carefully selected motion pictures, did not live to see this change take place. He did see the motion picture become one of the most valuable aids to the teacher and to the text, but found both to be even more necessary than before. But his prediction may have caused useless worry on the part of teachers and perhaps some antagonism toward this revolutionary tool which they thought might replace them in the classrooms. If there are teachers, still, who are disturbed by fears that these valuable aids will replace them, such fears should be discharged immediately. The appropriate use of visual sensory aids to learning will increase pupil interest, participation and independent action, thus increasing the importance and function of the teacher.

Very few, if any, of the commonly used visual-sensory aids are instructional in themselves. If used with groups which have not received earlier preparation and guidance by the teacher, much of the possible educative power will be lost. On the other hand, these same materials, properly used by trained teachers, make it possible to teach the child more in a given time, teach him more thoroughly, and he will remember the information or instruction much longer. The advantage gained by this procedure, easily measured, has been found to range from a small percentage to 40% or more, depending largely upon the favorable and unfavorable factors involved. The percentage gain, in carefully controlled classroom situations, has been great enough and consistent enough to cause progressive educators to look with favor upon the proper application of visual-sensory aids to instruction.

The discussion which follows does not intentionally recommend one type of visual-sensory aid over another, except in certain specific situations where one would seem to be more effective than another under given circumstances. The majority of the statements are made on the premise that each of the many different types of aids will have certain values, if properly applied; that some types are better for some situations; and that selections should be made in accordance with the problems at hand. The chief purpose of the book is to serve as a guide to those who desire assistance in selecting and securing visual-sensory aids which will contribute to the teaching of this or that specific subject or lesson.

The General Use of Visual Aids to Instruction

It is hardly necessary to go outside the realm of daily experience to bring to mind the importance of the visual representation in forming lasting impressions. We remember that which has been unusual and which has been seen clearly. The magazine, book or newspaper which does not use pertinent and abundant illustrations is limited in circulation. Industry has found the motion picture, the slide, the photograph, and the chart to be highly successful in the training of men; in showing manufacturing processes; and in encouraging the public to purchase. The motion picture industry, itself, has been accused of affecting our daily life with a force exceeded only by the combined influence of the press and the radio.

In the educational field, experimental evidence has favored the use of visual-sensory aids in practically every carefuly controlled experiment. This has caused the thinking educator to give consideration to educational possibilities. Schools have organized visual instruction departments, for the purpose of coordinating and centralizing effort. States have formed visual instruction departments or bureaus for the purpose of providing loan service of films, slides, and the like to those schools which could not afford to purchase the necessary materials. Nations have organized research departments and production facilities for the purpose of directing visual instruction activity and providing the necessary useful materials.

It is interesting to note that the great majority of the leading cities of the United States have well-organized and functioning visual instruction departments. A small part of the list includes such familiar names as Birmingham, Phoenix, Berkeley, Long Beach, Los Angeles, San Diego, San Francisco, Pueblo, Hartford, Bridgeport, Washington, D. C., Atlanta, Bloomington, Gary, Indianapolis, Sioux City, Atchison, Winfield, Cambridge, Detroit, Kalamazoo, Hibbing, Red Wing, Kansas City, St. Louis, Montclair, Newark, Trenton, Albany, Ithaca, New York City, Schenectady, Winston-Salem, Chicago, Cleveland, Toledo, Tulsa, Portland, Erie, Pittsburgh, Philadelphia, Reading, Scranton, Providence, San Antonio, Richmond, Seattle, and many others, in all parts of the United States.

Also many of the smaller city, county and district school systems have delegated the work of the visual instruction department to one or more persons on the regular staff. There are more than a

thousand such part-time visual instruction workers, scattered throughout the country.

Among the states and territories which have a loan service of visual-sensory aids to instruction are Alabama, Arizona, California,

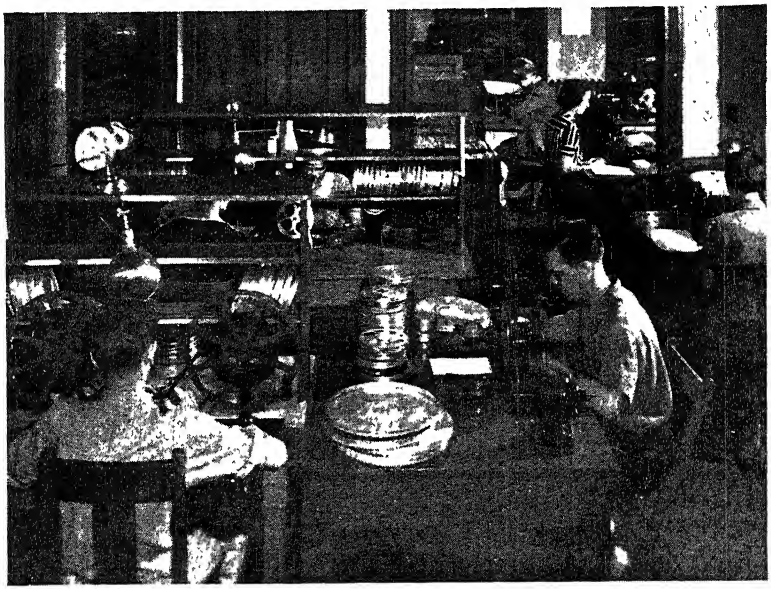


Photo Courtesy Visual Instruction Dept. University of Wisconsin

A Visual Instruction Department

Colorado, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts, Minnesota, Missouri, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Texas, Utah, Virginia, Washington and Wisconsin. The majority of these service bureaus have been in operation for several years. Other states have started this type of service or plan to do so soon.

Augmenting this service, we find numerous national and local museums ready to lend materials to schools. Notable among these are the American Museum of Natural History and The Metropolitan Museum of Art, New York; The Children's Museum, Hartford, Connecticut; Field Museum, Chicago; Buffalo Society of Natural

Sciences; Cleveland Educational Museum; Pennsylvania State Museum; Carnegie Museum; The Commercial Museum, Philadelphia; the Cambridge Museum for Children; St. Paul Institute; the Children's Museum of Detroit; Kent Scientific Museum, Grand Rapids, Michigan; Brooklyn Children's Museum; Huntington Museum and Art Gallery; University of Pennsylvania Museum; Erie Public Museum; St. Louis Educational Museum; and the Milwaukee Public Museum.

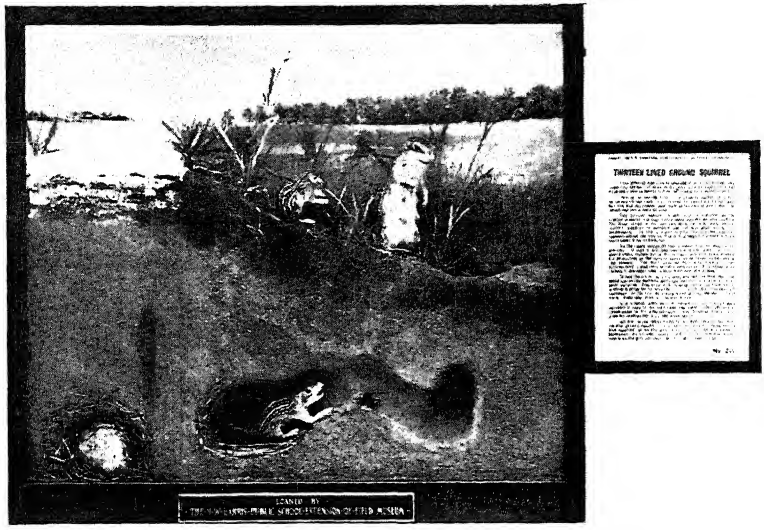


Photo Courtesy Field Museum

Exhibit from a Museum Loan

The United States Departments of Agriculture, Commerce, Interior and Labor; Bureau of Commercial Economics; Pan-American Union; National Museum; and other old and new federal and related organizations in Washington, D. C., offer loan and advisory service to schools and to other educational organizations. Many of these service bureaus have materials available for loan without charge, except for transportation. In the case of the Division of Motion Pictures, Department of the Interior, one or two reels of 16-mm. motion pictures, silent or sound, will be sent under Government frank, thus eliminating postage one way. The Office of Edu-

cation is giving special attention to the application of visual-sensory aids to instruction.

The American Council on Education provides a clearing-house of research and information for all who may be interested in problems relating to the visual instruction field, especially those relating to the use of motion pictures. The Committee on Scientific Aids to Learning is studying the effectiveness of sound filmstrips. The Association of School Film Libraries is coordinating the production and distribution of educational motion pictures, and the Motion Picture Producers and Distributors of America have selected short subjects for classroom use. In general, all types of visual aids are receiving more intelligent consideration than at any time in the past, and there is every indication of a continued and accelerated increase in the attention given to these effective teaching aids.

The developments in the United States are parallel in other countries. The Canadian Government Motion Picture Bureau produces educational, industrial and scenic motion pictures and slides for distribution throughout the Dominion. The British Museum offers its facilities to the schools of England. The excellent collections of paintings, photographs, slides and motion pictures in Berlin, Leipzig, Munich, and other German cities are used extensively among schools of all types. France has established production studios for the preparation of suitable educational films. The Belgian Museum produces and distributes educational motion pictures.

The Union of Socialist Soviet Republics (Russia) has used all types of visual-sensory aids—the school journey, the museum, the poster, the map, the stereograph, the slide, the play, the pageant, the motion picture and the radio—to combat the appalling illiteracy which existed at the time of the Revolution. In Moscow, there is a training school for visual instruction workers which offers a four-year course in the construction and use of visual aids of all types. Teachers are there trained to apply modern scientific developments to the educational field. The school trains authors, producers, actors and technicians, and has an enrollment comparable to that of teachers' colleges in the United States.

Italy has found the poster, the motion picture, the slide, and other forms of illustrative materials to be of great service since the beginning of the Fascist regime. The permanent headquarters of the International Institute of Educational Cinematography was

established in Rome, but the Institute has failed to function since the general disintegration of the League of Nations, which supported the Institute.

Similar application of visual-sensory aids to instruction is found in all parts of the world. Some cities in Europe have their own production studios and distribution service. The Australian Government Motion Picture Bureau has been in operation for several years. Various organizations in New Zealand, India, China, Japan, South Africa, Roumania, Australia, Brazil, Argentina, Chile and Mexico are giving active attention to the production and use of motion pictures and other visual aids.

A brief glance at the activities in various localities indicates that the leading school systems of the United States are making regular use of visual-sensory aids to instruction. The majority of the states have organized service bureaus to care for the needs of the schools which cannot well afford to purchase materials. Many state and private educational institutions are offering training courses in the use of audio-visual materials to enrich instruction. In Pennsylvania, this training is required for certification. Other states are giving consideration to similar requirements. In some of the city teachers' colleges, visual instruction courses are required of those who plan to teach in the fields of social, general, natural and physical science. Many museums are offering training courses for teachers in service. Similar extension courses are being offered by universities, colleges, and other teacher preparation institutions throughout the United States.

Visual instruction is receiving more and more attention from the educational leaders and leading educational organizations. Many of the state teachers' associations have visual instruction sections, which meet concurrently with other sections of the associations. Many of the history, science and geography sections of state and local teachers' associations include demonstrations of visual instruction materials and equipment on their programs. Several of the leading educational magazines, including official publications of state teachers' associations, are devoting space to the problems and practice of visual instruction. These tend to encourage intelligent consideration of materials which have been found to be effective in teaching.

The movement, therefore, has passed the initial stages. It has become a potent factor throughout the educational world. A brief

review of early experimental evidence may serve to establish some of the substantial reasons for the rising prominence of the educational tools generally classified under the term, "visual-sensory aids to instruction."

Use of Visual Aids in Industry

The majority of the more common visual aids now in regular use among schools, were first applied to the training problems of industry. Industrial groups, in many instances, were composed of curious mixtures of American and foreign-born workers. Many could not understand the printed word, especially if in English. It became necessary, therefore, to devise ways and means of teaching safety, clealiness, co-operation, and the intricacies of the individual duties. Pictures were found to be of great value, inasmuch as all could understand the pictured message.

Exhibits, slides, charts, posters, silent and sound filmslides and motion pictures have become important tools in the inner and outer relationships of the more prominent industries. The General Electric Company, for example, has a very complete assortment of glass slides, filmslides and motion pictures of practically all phases of the electrical industry, as well as the application of electrical devices to other industrial fields. These are used for technical instruction, sales promotion, public relations, and very extensively for instructional use in educational groups of all kinds—in and out of school.

The Ford Motor Company uses motion pictures of the National Parks and other scenic areas to encourage travel, and has produced many films for general educational use. General Motors, Chrysler, RCA, and literally dozens of large and small industries use motion pictures, filmslides, and exhibits for similar purposes.

The Bureau of Mines, United States Department of the Interior, has a large group of motion pictures of the mineral industries, which are available for use anywhere in the United States at no cost except for transportation. The Extension Service of the United States Department of Agriculture has a very complete library of visual aids covering practically all phases of the agricultural industry. In addition to motion pictures on many subjects, there are slides, posters, exhibits, pamphlets and books with carefully selected illustrations. The Forest Service (U.S.D.A.) has many more panels, exhibits, slides and films available for loan to

educational groups or for sale to those who desire to use the material regularly through the school year.

Industries use motion pictures, slides, filmslides, charts and exhibits for both direct and indirect advertising. There are exhibits of silk worms and silk; sugar in the various stages of refining; salt and salt mining methods; spices from all parts of the world; the manufacture of linen, cotton and woolen goods; paints and pigments; the manufacture of pens and pencils; and of pottery making. There are charts showing the different meat cuts; products of the various sections of the United States; how to prepare certain foods properly; balanced diets for children of all ages; the arrangement of a model farm; and many other interesting subjects.

Slides and filmslides are available to show the complete details of manufacturing processes; history and development of the industry; and such other information as might be of interest to the groups requesting service. Motion pictures cover all phases of the majority of the leading industries of the United States. Many of these fine films contain little or no direct advertising material, but attempt to give a true picture of the inner workings of the industry.

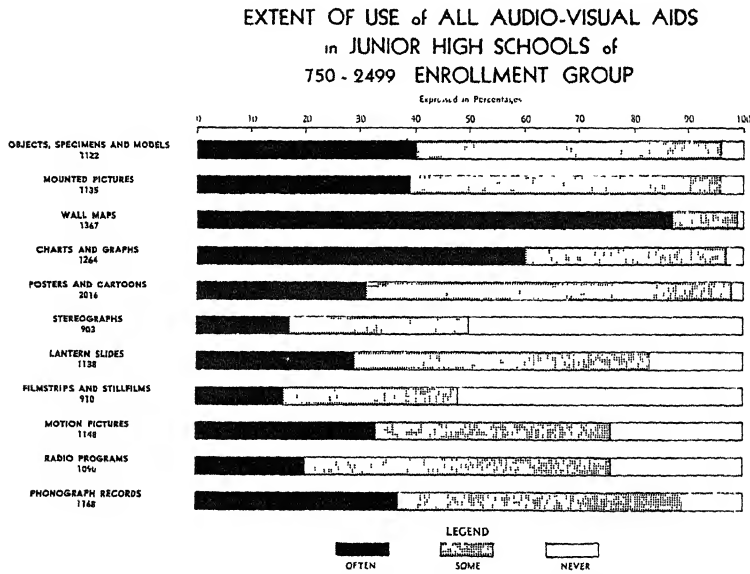
Use of Visual Aids Among Schools

The survey* of 8,806 schools and school systems, conducted by the Office of Education and the American Council on Education, contains some interesting information concerning the use of visual and other aids among schools. It is rather evident from the reports of manufacturers that the survey does not cover all the schools or school systems which have visual instruction equipment and are using visual aids. On the other hand, it is valuable to note that the 8,806 schools and school systems reporting have 37,671 instruments for the projection of pictures. These include all types, from the inexpensive filmslide projectors to the most complete equipment for the projection of sound motion pictures in the school auditorium. In addition, it was reported that these same schools owned 11,501 radio receiving sets, nearly a thousand centralized sound systems, approximately three-quarters of a million phonograph records, and more than three million glass slides.

These figures, in order to be meaningful, require a much more complete analysis of the survey than it is possible to present here.

*Koon, Cline M., and Noble, Allan W., "National Visual Education Directory," 1936. Published by American Council on Education, Washington, D. C.

Any survey is limited by the cooperation and accuracy of those who provide the information. Accordingly, the most important information derived from the survey is that which relates to the use of these various aids among those schools which did report. As an example, the accompanying graph summarizes the extent to which all types of audio-visual aids are used among a certain group of junior high schools which reported. It will be noted that this summary includes only junior high schools with enrollments of 750 to 2,499, and that reports from approximately 2,000 such schools were received.



Graph Courtesy Office of Education (1936 *Survey*)

The most significant information one might gain from the junior high school graph is a rather clear impression of the extent to which the different types of audio-visual aids are actually used in the classrooms. The amount of white space on each bar is very small, except for the bars indicating reported use of stereographs and filmslides. These two aids, low in cost and small in size, are less likely to be reported accurately, and are used more extensively in the elementary grades. Accordingly, it is doubtful if either is

represented fairly in the above graph. As might be expected, the non-mechanical aids are used more extensively than those which require machines for projection or reproduction.* It is interesting to note, further, that phonograph records are used more regularly among the schools reporting than any of the other mechanical aids.

A close study of the survey and related information makes it rather safe to conclude that the majority of the schools, public and private, in the United States are making regular use of some type or types of audio-visual aids to instruction. Some are using abnormal quantities of certain types and subnormal quantities of other types. On the other hand, many are employing a truly balanced program, applying school journeys, museum materials, photographs, slides, filmslides, motion pictures, phonograph records, and other visual, audio-visual and sound aids when and as they are needed.

It should be mentioned here that, although the 1936 survey is the most complete to date, many more schools have begun the systematic use of audio-visual aids during the past three years than during any similar period in the past. Thousands of filmstrip projectors, motion picture projectors, radio receiving sets, phonographs, and school sound systems have been purchased by schools. Also, it is reported that schools have purchased thousands of filmslides, motion pictures, lantern slides, and phonograph records, which would change the general picture considerably from what it was in 1936.

The extent to which these valuable aids are used and the degree of effectiveness with which they will be employed in any teaching situation will depend almost entirely upon the amount and quality of the training the teacher has received. The greatest factor retarding the more extensive and more intelligent use of visual-sensory aids is the inadequate training of teachers to make use of the materials available.

*What Experience Has Taught Us About Visual Aids***

1. The use of visual instruction may be traced back through the educational history of the race. In primitive times, boys were taught to hunt and fish and girls to cook through imitation, observation and participation plus the necessary language explanation.

**Compare graphs on subsequent pages as follows:*
Mounted Pictures—p. 43; *Motion Pictures—p.* 120.
Phonograph Records—p. 128; *Radio Programs—p.* 135.

***McClusky, et al., "The Place of Visual Instruction in the Modern School," 1932. (Syllabus of a proposed text.)

Early records were picture records. Cave men drew pictures to warn and inform. The Greeks utilized the school journey, the sand as a blackboard, and real objects or things in their instructional processes. Forerunners of modern education used visual instruction. Such famous pioneers as Comenius, Rousseau and Pestalozzi emphasized it.

2. Whereas schools of the past used visual materials, modern science and inventions have opened vast new possibilities in the development of concrete materials for teaching purposes.

(a) The invention of the photograph and of photo-engraving have made possible the illustration of magazines, newspapers, books and school texts on a scale heretofore unimagined.

(b) The microscope and telescope have revealed the existence of worlds that were unknown a short time ago.

(c) Stereographs and stereoscopes have brought the illusion of three dimensions to the classroom.

(d) The motion picture, with and without sound, has become a major factor in modern life for the dissemination of information, knowledge and ideas.

3. The introduction of visual materials into the modern school on a broad scale has enabled teachers to learn something of their use and value through experience. Some of the more general notions which have been developed as a result of actual experience are:

(a) That visual aids are most effective when closely correlated with the course of study or curriculum.

(b) That visual materials will not supplant the text book, or teacher, but will supplement and increase the effectiveness of the teacher and text. Hence the term, "visual aids."

(c) That the most effective visual lesson is one that is treated as any good lesson should be handled. The mere exposure of children to visual materials will not, by some mysterious process, teach them. Teachers must prepare for the visual lesson in advance.

1.) Organized units of visual materials are desirable.

2.) Teachers should be familiar with visual aids before presenting them.

3.) Pupils must be held responsible for material presented.

(d) That the organization and administration of visual materials must be such that they are available at the precise moment when the teacher wants them.

(e) That the inherent nature of visual aids—their concreteness—is such that they should be excellent in quality and accurate in detail. Misinformation obtained through a visual aid is inexcusable.

(f) That a few pertinent illustrations are better than a score or more of less related ones. For example, the intensive study of a few excellent slides and stereographs is, in most instances, better than a succession of somewhat related pictures.

(g) Visual aids should make accessible in the classroom that which is inaccessible. Visual aids are valuable also in re-creating in the classroom familiar subject matter.

(h) No one type or class of visual aids should be used to the exclusion of others. Each has its own value and use.

4. Actual experience in the use of visual aids has taught us much about the various types of visual aids and their own values.

(a) The stereograph has been found to be valuable as an individual study experience.

(b) The stereopticon slide or filmslide forms an excellent basis for the socialized recitation.

(c) The motion picture is an effective summarization device.

(d) The chart and diagram are effective in presenting abstractions and in assisting analysis.

Experimental Evidence

There have been many minor and numerous major experiments in the field of visual instruction during the past twenty years. The majority of these have been reviewed in various issues of *The Educational Screen* and some have been published in book form. The list of investigators includes, among others, the names of those of high reputation in the field of educational research, such as Frank N. Freeman, C. J. Judd, Ben D. Wood, F. D. McClusky, V. C. Arnspiger, George D. Stoddard, Daniel C. Knowlton, J. Warren Tilton, P. J. Rulon, J. J. Weber, Edgar Dale, William Lewin and W. W. Charters.

Dr. Frank N. Freeman, in summarizing the results of a series of experiments conducted by himself and twelve others in eight cities and three universities, states "—no support to a belief that pictures may be substituted for language. It does indicate, however, that they have a definite function to perform. This function is determined by the nature and purpose of the instruction. The purpose of instruction at one time is to lay the foundation for thought, reflection, generalization, application. This foundation consists in direct experience with material objects. . . . The evidence is that pictures are an invaluable means of getting certain kinds of experience of a concrete sort."

Knowlton and Tilton conducted an experiment with the use of the "Chronicles of America Photoplays" in Troup Junior High School, New Haven, Connecticut.* Ten of the photoplays were used with the experimental group and the results obtained were contrasted with those secured with regular class instruction. Among the more significant results were the following:

1. The ten photoplays made a large contribution to the teaching of an enriched course of study, increasing the pupils' learning by about 19 per cent.

2. This contribution was of such a magnitude that average children with the aid of the photoplays learned as much as bright children did without them.

3. The photoplays were most effective in teaching a knowledge of inter-relationships involving the interaction of events and of forces. They increased the pupils' learning of this sort 35 per cent, or about twice as much as they increased the gaining of all kinds of historic knowledge.

4. The next largest contribution was to the teaching of historical personages. The increase of learning of this sort attributable to the photoplays was 23 per cent.

5. The contribution to the teaching of historical geography was 19 per cent.

6. In the part of the experiment in which there was no review between teaching and retest for retention, the contribution to retention was greater than, or at least equal to, the contribution to learning. This was the contribution of four photoplays to the teaching of the Revolution. The pupils learned 25 per cent more by the use

*Knowlton, Daniel C., and Tilton, J. Warren, "Motion Pictures in History Teaching," Yale University Press. 1929.

of the photoplays and remembered 27 per cent more after three months.

7. The contribution to the retention of knowledge of historical relationships other than those of time was greater than the contribution to gaining this knowledge. Of such relationships, pupils learned 35 per cent more, and remembered 43 per cent more.

8. The effect of the photoplays upon pupil participation in classroom discussion was in detail as follows:

(a) more recitations were made at the request of the teacher;
(b) a larger percentage of the class recited;
(c) those reciting did so more often;
(d) on these occasions more hands were raised;
(e) more remarks were volunteered by the pupils not directly as a result of a teacher's question, i.e., upon those occasions when their own desire to participate more evidently prompted them;
(f) a larger percentage of the group so volunteered;
(g) those volunteering did so more often;
(h) on these occasions more hands were raised for permission to participate;
(i) more questions were asked;
(j) a larger percentage of the group asked questions;
(k) those who asked questions did so more often;
(l) fewer contributions came in as a result of outside interest;
(m) a larger percentage of the group made such contributions;
(n) those contributing did so less often.

9. The increase in the total number of pupil participations attributable to the use of the photoplays was 10 per cent. This increase is equivalent to forty-six more participations in a year by each pupil, or about 1,600 more in a thirty-five-pupil section.

10. Seeing the photoplays caused the pupils to read voluntarily more supplementary history material under controlled classroom conditions:

(a) 40 per cent more reading was done;
(b) a larger percentage of the group chose to read;
(c) the average amount, for those reading, was larger.

The Eastman experiment, conducted by Wood and Freeman, stands as one of the most comprehensive to date. The experiment

was conducted during the spring months of 1928 in twelve large city school systems in which nearly 11,000 children participated. The topics studied were in the fields of geography and general science. The outcome of the teaching was measured by three tests. In both geography and general science, the film-instructed groups were greatly superior to the non-film groups. The following statement was made in a summary of the experiment:

"If we examine the average gains made by the entire group of children in all cities and on all topics taken together, we find that the film group excelled the non-film group by 33 per cent of the standard deviation of all the scores. In the topics on General Science, the gains of the film group exceeded those of the non-film group by 15 per cent of the standard deviation. . . . These are substantial and reliable differences. The detailed evidence that the differences are reliable is presented in the body of the report."

The above refer to only a few of the many experiments which have been conducted in the field of visual instruction. Other experiments will be mentioned as they may relate to the consideration of certain forms of visual aids. It is interesting to note that, almost without exception, the many experiments to determine the difference between the visual and non-visual method of teaching have indicated a very favorable advantage for the application of visual-sensory aids to instruction.

The Development of Audio-Visual Aids

It has been reported by unimpeachable authority that when Thomas A. Edison began his experiments to produce pictures of articles in motion and reproduce those pictures he had in mind pictures which would illustrate recorded music. The results were not entirely satisfactory, and early motion pictures were thought by him to have no great commercial or educational possibilities. A group of small but enterprising merchants and peep-show operators had a different idea, which later developed into the great motion picture industry of today.

But pictures and sound were developed separately until the appearance of synchronized sound motion pictures, about thirteen years ago. The reunion was reasonably satisfactory and was developed into the fine sound picture of today. Following in a year or two, sound pictures for educational use were developed. Some believed the sound film would soon replace the silent among schools,

as it has among theatres. This has not occurred, but there has been unmistakable progress in both production and utilization of motion pictures—silent and sound. There is a tendency toward the greater use of sound films, except in those situations where sound does not contribute to the instructional value of the picture.

Sound picture enthusiasts have stated that silent educational films are as old fashioned and ineffective as silent films for entertainment. Silent picture enthusiasts have maintained that the sound picture tends to interfere with the participation of the classroom teacher; is not as effective as the silent film in presenting many subjects; is more complicated to use; and is more expensive for both films and equipment.

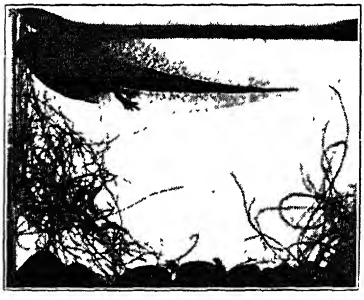
There are many others, increasing in number, who believe that both sound and silent aids have a definite place in the instructional program. They believe that some motion picture lessons should be presented on silent films, supplemented by pupil or teacher explanation while being projected. They believe that in many instances the teacher who is familiar with the background, training and objectives of her class can fit the film into that situation better than can some lecturer who does not have this information. On the other hand, they believe that certain scientific or technical films can be explained more effectively and more accurately by leading scientists and technicians. They believe also that illustrative or related sound is necessary to convey the full meaning intended for the pupil in the classroom. These persons are securing equipment which will accommodate both sound and silent films, and are using both.

These same school administrators, supervisors and teachers are making use of other sound and silent aids wherever they may seem to add to the effectiveness of instruction. They are using phonograph records, radio programs, sound distribution equipment, sound re-enforcing equipment and recording equipment, with greater frequency and increased effectiveness from month to month. They are using exhibits, charts, photographs, stereographs, glass slides and filmslides where these aids seem most effective or most readily available. In place of quibbling over the relative merits of silent and sound films, they are making use of the best of each, while hoping for greater development and use of each, and provide the real reason for the combination of the two terms "Visual Aids" and "Sound Aids" into one shorter and more adequate term "Audio-Visual Aids."

Types of Visual Aids and Their Uses

Classroom Experiments and Blackboard Demonstrations

THESE aids to instruction are familiar to nearly all teachers. The classroom experiment, conducted by the students or by the teacher, offers many opportunities for satisfying the creative urges and instincts of the pupils. The pupils should be relied upon as much as possible for this type of classroom procedure. Science and agriculture texts include instructions for the germination of seeds, growing of insects, preparing an aquarium or a terrarium. Biology, physics and chemistry texts outline an abundance of experiments which may be conducted by the students. Some of these experiments are too tedious for instructional economy and should be eliminated. Other experiments are pertinent and effective.



An Aquarium Tadpole

One teacher in a junior high school develops much interest in silk, its production and importance, through the culture of the silkworm in the classroom. Eggs are secured, an appropriate case is placed in the corner of the room, and the pupils in that room are able to watch, from day to day, the gradual change from one life form to another. A few skeins of silk and silk samples serve to complete the story in a manner many times as effective as the most interesting story in a text.

There are a few simple rules which should be observed in connection with the use of all visual aids to instruction, particularly classroom experiments and blackboard demonstrations. They should be directly related to or a part of the information and instruction to be imparted to the pupils at that time. They should be accurate and purposeful, well planned in advance and executed with care. Most of all, any demonstration material in the classroom should be clearly visible to all in that room. Frequently, effective instructional procedure has been wasted because some members of the class could not see the experiment or demonstration clearly.

Pennsylvania teacher-preparation institutions have developed a technique for the use of the blackboard, and a methodology applying the principles included in the technique.*

The School Journey

The school journey or field trip, as it is often called, is a school exercise designed to provide sensory experience relative to such phenomena as cannot be brought into the school room. It involves the conducting of pupils to places where the subject matter of instruction—scenes, objects, situations, relationships, etc.—may be studied to the best advantage.

1. The school journey contributes meaningful instruction to practically every subject.†

(a) The objectives of art are the more readily realized through visits to churches, galleries, scenic spots, landscapes, beautiful architecture, model buildings and homes, artistic windows where clothing, home furnishings, etc., are displayed.

(b) Geographical relationships are the better understood when children are brought into direct touch with life situations, climate, occupations, means of transportation, communication, etc.

(c) Literature is enriched and the desire to read stimulated through literary rambles—visits to homes of authors, to their resting places, to the spots that inspired their writings. The school journey furnishes a valuable medium in this scheme.

2. Advantages of the school journey.

(a) The school journey is a co-operative enterprise. Teacher and children join in the project with the child the active agent and the teacher the counsellor and guide.

(b) Shows phenomena in their natural settings.

(c) Puts children in direct touch, under learning situations, with things, persons, movements, relationships, environments, occupations, trends, functionings.

(d) Shows three dimensions, natural color, qualities, motion, etc.

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*Educational Monographs, "The Object-Specimen-Model, and a Blackboard Technique," Department of Public Instruction, Harrisburg, Pennsylvania.

†Hoban, C. F., "The School Journey," Educational Monographs, Department of Public Instruction, Harrisburg, Pennsylvania.

(e) Offers opportunities for socializing instruction and blending school activities with community life.

(f) Supplies concrete, realistic, meaningful elements.

(g) Connects directly objects of knowledge with their respective symbols.

3. Limitations of the school journey.

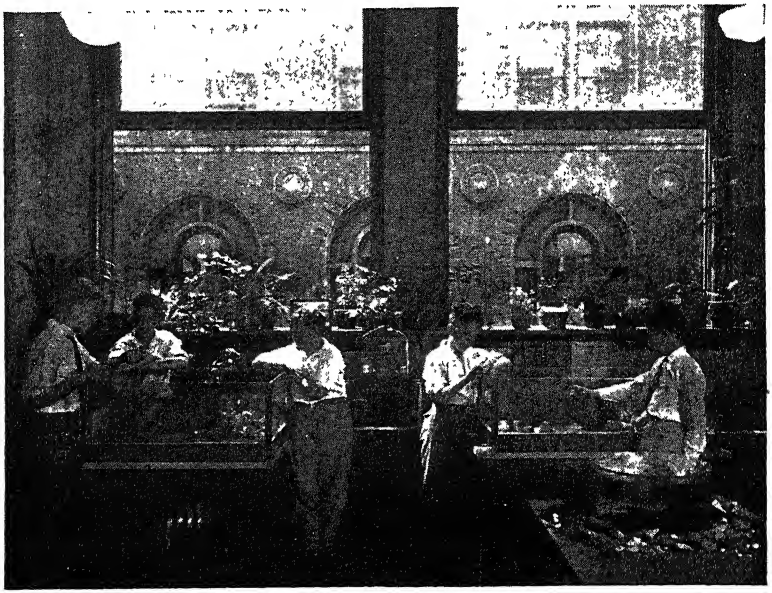


Photo Courtesy American Museum of Natural History

School Journey Pupils in the Nature Room of a Museum

(a) Requires a great deal of careful organization. Weather conditions and transportation problems sometimes combine to defeat the purpose of the journey.

(b) Much time may be wasted getting to and from the objective.

4. Technique recommended for organizing and conducting a school journey—

First Step—Evaluate the advantages in taking the particular school journey under consideration in order that as many contacts as possible may be utilized profitably.

Second Step—Determine the purpose for which the journey is to be conducted; or a possible combination of purposes.

Third Step—Examine survey data for:

(a) Materials that will develop correct concepts.

(b) Situations around which activities may be organized that will assist pupils in developing desirable attitudes, skills, and habits.

Fourth Step—Make necessary arrangements with:

(a) School authorities.

(b) Owners or representatives of places to be visited.

Fifth Step—Initiating the journey.

(a) Develop the need for making the journey during class discussion or group activity.

(b) Have pupils fix definitely the aim or purpose of the journey.

(c) Teacher preparation involves familiarity with place, route, features, necessary reference material.

(d) Pupil preparation includes:
Equipment—notebook, field glasses, proper clothing, etc.
Have pupils fix definitely the aim or purpose of the journey. Spirit of alertness, a determination to meet and solve situations.

Sixth Step—Instruction en route and the lesson.

(a) On the way, pupils alert, cultivating keen observation, at times noting and listing things seen; teacher should be a counsellor and guide.

(b) At the place—the definite lesson; pupils utilizing initiative, self-activity, observation; teacher guiding the organization of pupil observations.

(c) The return—pupils exchanging ideas, freely discussing experiences, asking questions, etc.
Reports from pupils.
Discussion of reports; questions by pupils and teacher; evaluating reports.
Co-ordinating the work.

Seventh Step—Appraising the lesson as to:

(a) Teaching values.
Enriching and vitalizing.

Motivating.
Socializing.

(b) Constructive influence on pupils' appreciations, attitudes, habits, skills.

5. The location of the school will determine the nature of the trips and excursions which may be taken.

(a) School journeys possible in rural communities:
Wild flowers.
Insects.
Birds.
The action of frost.
The work of running water.
Earth features and earth forces.
Vegetable and animal life.
Country industries.

(b) School journeys possible in cities:
Manufacturing industries.
Commerce.
Physiological features observable in parks and in the community.
Human phases of geography—races; nationalities; customs; costumes; various trades and shops; products and manufactures; intercourse; transportation; commerce; evidence of civic organizations.

Plays and Pageants

Dramatization of leading works in literature, historical events, and the like, has been and is one of the very effective methods of arousing interest, teaching, and developing proper appreciation. Pageants have entertained and instructed young and old for many centuries. They may be developed to present almost any historical or geographical situation. Pupils become intensely interested in participation.

The limitation of instructional time makes it necessary to give careful consideration to the proper time and place to develop pageantry or dramatic presentation. The event or situation portrayed should be of enough importance to more than warrant the great amount of time and energy required in preparation. Incidentally, the greatest good will come to those pupils who have a part in the

enterprise, so provision should be made for as many as possible to participate.

Another limitation of the pageant is that it is quite apt to require weeks or months of preparation; an hour or more for presentation; and then be forgotten. The last is the most serious. One far-sighted school superintendent eliminated the temporary nature of a pageant depicting the history of his state by having the entire performance photographed with a motion picture camera. The preparation of the pageant had cost thousands of dollars, in time and money. Within a period of two hours, it had passed and would

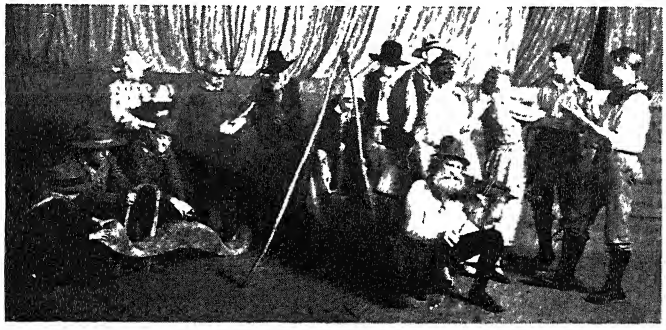


Photo Courtesy Salt Lake City Chamber of Commerce

Pageantry—Scene from Utah History

have been lost except to the vagueness of memory. But the expenditure of approximately a hundred and fifty dollars for cameraman, film, titles, etc., gave the school a permanent record of the pageant, which could be projected as often as might seem desirable for teaching purposes.

Furthermore, the classes which were studying the history of their state were asked to prepare titles for the film. This required much reading and delving into historical records. Groups of pupils went to the historical museum of the state for information and assistance. Other pupils went to the libraries for stories of the early history of that section. Still others went to the homes of the oldest settlers of the community for information and for stories of the early days. The various records, readings and stories were then compared for the purpose of determining the probable true course of events. Incidentally, these pupils found that some of the scenes in the pageant had been incorrect in their interpretation of events.

But the greatest value was not that of securing an accurate pictorial record of the history of that section. Instead, the greatest value was to the student in the history classes of that city's schools. The teachers in charge of history classes were positive in their statements that the students learned more state history in the period of six weeks required to edit the film than the same group of students would have learned throughout the school year under the usual teaching procedure.

Objects—Specimens—Models

The best explanation and suggestions concerning the use of objects-specimens-models is found in Dr. Hoban's monograph on Visual Education and the School Journey.* They are generally considered to be of great value in educational procedure.

"The object is the thing itself—plant, fruit, vegetable, bird, animal, etc.—that can be brought into the classroom for study. The specimen is a sample, a part intended to show quality, one of several things which represent all—for example, a piece of coal, wood, cloth, etc. The model is a small-size representation, as for example a building, engine, heart, lungs, globe, etc.

"The best place to study cotton would be at a cotton plantation. But . . . children cannot go to a cotton field. The cotton plant, however, with its flower and fruitage, can be brought to the school room where the children, in addition to seeing its arrangement in the boll, can handle the cotton, feel the fibres, pick out the seeds, go through the process of combing it and twisting it into strands. This exercise, supplemented with photographic material—showing the cotton field, method of planting, stages of growth and cultivation, and the processes through which the cotton passes from the boll to the manufactured garment—will enable the child to understand the relationship between cotton as a plant and as an article of clothing.

"Pages are required to set forth the principles of an engine or motor. The miniature model, amplified with pictorial material, gives a correct representation of the thing and enables the pupils to see the relationship of its various parts. We too often take a considerable period of time to describe verbally or through the printed page a relationship which could be portrayed more accurately and vividly in half or a quarter of the time by means of the natural setting, environment, situation, object, specimen, model or picture. Only

*Hoban, C. F., "Visual Education and The School Journey," Department of Public Instruction, Harrisburg, Pennsylvania. 1930.

actual tests of the use of these aids are needed to convince the teachers of their value."

The School Museum

One of the primary requirements of the successful use of visual-sensory aids is that the materials shall be available for use at the appropriate time in the instructional plan. For this purpose, the school museum becomes almost a necessity in every school system or school unit. Many are inclined to think of a museum as a place where unusual specimens are stored behind glass doors, to be viewed occasionally and to gather dust and other signs of age. On the contrary, the school museum can become the most useful service unit in any school.

The requirements for a school museum are simple. Some space is needed, and the space should be easily accessible to all teachers. A part time or student clerk is needed to check materials as they go out and as they return. Aside from these requirements, ordinarily available in any school, is needed an interest in more effective teaching. In most instances, the pupils will do, with enthusiasm, the major part of the work required in collecting and preparing specimens.

The school museum should provide space for the object-specimen-model collection of the school, except possibly those items which are peculiarly adapted to the use of the teacher in one section or room. It should provide space, also, for posters, picture collections, industrial exhibits, special exhibits, glass slides, filmslides, and such motion pictures as may be owned by the school. In addition, the school museum service might be called upon to handle the circulation of projection equipment, screens, phonographs and records, reference books, and the like. In many instances, the school library staff will be able to take care of the school museum service.

There are many sources from which desirable exhibit materials may be secured, at little or no cost. Industrial organizations of almost every type are ready and anxious to cooperate with those schools which desire to teach the story of various products and commodities. Salt mining organizations provide exhibits of salt in the various stages of manufacture, with illustrations of mining and refining methods; sugar refineries furnish charts of the processes involved in converting cane and beets to sugar; flour and cereal manufacturers distribute among schools booklets, charts, exhibits, and

other materials dealing with the manufacture and use of their products. The same is true of almost any industry of importance—cotton, wool, forest products, mineral industries, fruit, fishing, silk, artificial silk, and many others.

A brief list of some of the sources from which suitable exhibit materials and other classroom aids may be obtained will be found on page 199 of this publication. When writing to these firms for materials or information, it will be well to do so on the official stationery of the school and advisable for one of the teachers or the principal to write the letter. The majority of the exhibits will be furnished to schools at little or no charge. The industrial organizations are anxious to have these exhibits placed in the hands of those who will make intelligent use of the materials, but are not interested in providing playthings for the pupils in classes.

All museum materials available in the school—including every type of visual aid—should be catalogued and classified carefully. A copy of the classified list should be given to each teacher, so the teacher may know which of the materials pertain to his or her field. A simple mimeographed list would be inexpensive and satisfactory.

The school museum can be adapted to almost any situation. It can be of any size—housing the materials for a single-room rural school, or for an entire city system as in Cleveland, Buffalo, St. Louis, and other cities. It could contain any number of specimens, from one to one hundred thousand, or more. And it should become a definite part of every school unit or system.

Those who may be interested in preparing special exhibits for effective instruction concerning local or general matters will find many helpful concrete suggestions in the book, "The A B C of Exhibit Planning," by Evart G. Routzahn.* Dr. Routzahn has published smaller pamphlets on exhibit and chart making, which are available at low cost.

Graphs

Graphs are extremely important in presenting many kinds of information in a way that it may be understood readily and clearly. It is hardly necessary to devote any great amount of space in this bulletin to the technique of preparing graphs of various kinds.† The chief requirement of graphic representation of all kinds is un-

*Routzahn, Evart G., and Mary Swain, "The A B C of Exhibit Planning," The Russell Sage Foundation, New York, 1919.

†Some simple graphs appear on pages 43, 120, 128, 135.

questioned accuracy. Instructions for making accurate graphs of all kinds can be found in any text on elementary statistics. Students in the upper grades are able to construct very satisfactory graphs and should be given elementary training in graph making at an early age. Statistical tables of all kinds are hard to read, tiresome, and often unintelligible to the reader, young or old. In nearly every instance, the same information can be presented graphically, retaining the desired "scholarly" appearance and meeting the usual requirements for higher degrees.

Mrs. Dorris* lists the following general rules to be observed in teaching children how to make graphs:

1. Use a good metal-edged ruler and sharp pencil with hard lead. Ink the lines later.
2. Use smooth hard-surfaced paper that is capable of taking both ink and water color easily.
3. Be sure that all data are accurate and up to date before work is begun.
4. Leaving ample space to the left, construct a series of bars starting at a zero line.
5. Space the bars evenly, not too close or too far apart.
6. Encourage the use of guide lines placed at regular intervals. These greatly aid in mentally measuring the comparative length of the black or colored bars.
7. Do not print on the bars. All printing should be at the left of the zero line or horizontal-bar graphs and at the bottom of the zero line in a vertical-bar chart.
8. Numbers denoting the scale used should appear at the top of the series of guide lines.
9. If pictures are used with bar graphs to attract the attention, it is best to place them at the left of the printing so they will not interfere with the reading of the graph.

Similar instructions are included for the making of circle graphs, curve graphs and picture graphs, changing the technique in accordance with the type of representation used.

Maps and Globes

Maps may be of almost any type, subject, form, color or dimension. Usually they are found to be extremely valuable in teaching

*Dorris, Anna Verona, "Visual Instruction in the Public Schools." Ginn & Co. 1928.

the various phases of geography and history. There are relief maps, physical maps, political maps, temperature maps, product maps, historical maps, and miscellaneous maps. Each has a definite and helpful purpose, if properly constructed and applied. All maps should be strictly up to date in presenting the subject matter and should be corrected as frequently as may be necessary. The presentation of inaccurate visual materials is inexcusable.

The long established map producing and distributing organizations, the names and addresses of which can be found in the leading teachers' and other educational magazines, offer very complete and economical service to schools. (See page 202.) There are some schools which are not able to purchase frequently revised maps in as complete sets as are needed to serve adequately. Those schools will do well to investigate the possibilities of preparing or purchasing map slides, for projection on the blackboard or on any other suitable surface. Such slides may be constructed for as little as ten cents each in black and white, with but little additional cost for appropriate coloring or tinting.

The prepared map slides are accurate in construction and are especially well adapted to blackboard work. The map slide has many advantages. It may be purchased cheaply, stored in small space, transported readily, and used for special place identification on blackboards without damage. There are other map slides available from various sources, including aerial maps of sections and cities, product maps of various types, maps of national parks, river basins, and the like. The enterprising teacher can, with the aid of the Keystone Home-Made Slide Set, prepare the majority of the outline maps needed for any geography or history course, and will need to purchase only the detailed maps.

*Teaching with Charts, Maps, Graphs, Diagrams**

1. Advantages:

(a) A peculiar product of the visual sense is the wealth of plane relationships which it effects. Pictures, maps, charts, graphs, and diagrams take advantage of this peculiarity. In miniature, outline, trend, or figure, they depict on a flat surface the essential properties of the real situation.

(b) Maps lend themselves to classroom production. Among the possibilities are political, outline relief, color—physical

*McClusky, et al., "The Place of Visual Instruction in the Modern School."

and contour maps. Pictorial maps are of special value in that they are symbolical.

(c) A few charts summarizing the most important ideas and figures to be presented in a lecture or discussion can be made at small cost.

(d) Graphs are of particular value in presenting statistical information.

(e) The chart or diagram gives the teacher and class something in common as a focal point of attention.

(f) They may be carried from place to place easily.

(g) They are permanent and stand hard usage.

(h) They lend themselves readily to use at a moment's notice, at almost any point where an audience may be gathered.

2. Limitations:

(a) The chart should be made large enough to be seen by all.

(b) It is limited in the scope of material which can be presented by means of it.

(c) Unless students have been trained how to read charts, graphs and tables, the instructor will have to spend considerable time in explanation. This results in (1) a considerable waste of time, and (2) a neglect of the content itself.

The Sand Table

The sand table is probably the most adaptable of all visual aids. It may be used from the earliest pre-school or play activities through all the grades, high school, college, university, in the army, in engineering, in landscape gardening, in real estate selling, and in many other situations. Teachers of children in the lower grades may use it as a motivation project for reading and elementary mathematics. Teachers of higher grades may use it in geography, history, nature study, general science, agriculture and hygiene.

The chief limitation of the sand table is that projects prepared on it are subject to disarrangement or destruction, if carelessly handled. Those who may desire more permanent contour maps or other projects will do well to use papier-mache or a mixture of salt and flour. If molding clay is available, it may be used successfully.

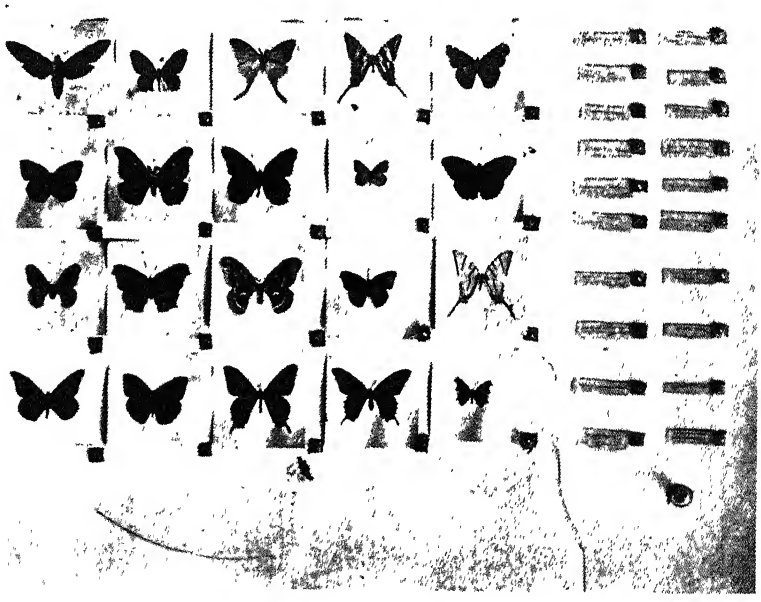
A good sand table for the average room should be approximately 8 x 4 feet in size, and about a foot in depth. The height from the floor should be determined by the average age of the usual

group which will be using it and should be such that it will be accessible to all. It should be a little more than half filled with sand of an even texture, and provided with a small shovel to be used in moving larger quantities of the sand from one location to another. In many instances, it is desirable to have a back-board extending upward eight to fourteen inches, for the purpose of providing backgrounds and to use in labeling the material prepared in the sand.

The Electric Map

Another type of visual aid which contributes liberally to the learning process is the electric map. Either flat pictures or specimens may be used in the construction of such a map, and the wealth of material available in magazines and other publications offers an unlimited source. Insects, leaves, pictures of birds, animals, and the like may be used extensively.

The first requirement is a piece of fibre board approximately 24 x 30 inches in size, or of any other desired dimensions. It is better to use something through which holes may be punched read-



Front of an Electric Map

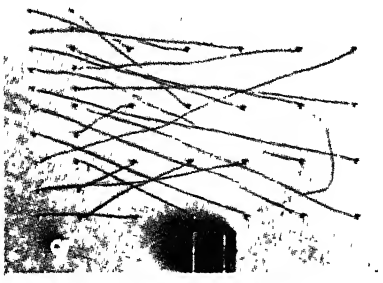
ily, as this will facilitate the construction of the map. In addition, the following will be needed:

40 to 60 stove bolts, ½ inch in length
One spool of No. 25 insulated copper wire
One "C" radio battery, 4½ volts
One automobile head lamp, 6 volts
The specimens to be mounted on the map

This complete set of equipment will cost about $1.50, and may be used over and over as needed. The smaller items may be secured at any radio or electrical shop and the plaster board from a lumber yard.

The map which is shown in the illustration below was arranged to accommodate twenty specimens. Spaces approximately five inches square were marked off and bolts were put through the lower right hand corner of each square. The bolt was inserted from the back with the nut on the front of the map.

At the right side of the map, twenty bolts are placed in two rows of ten each. There should be as many bolts along this side as there are in the map. These two rows should be four or five inches apart and the bolts from one to two inches from each other in the rows.



Back of the Map

A piece of the insulated wire is used to connect one bolt in one of the two rows at the left of the map to one of the bolts at the right of the map, as shown in the picture of the reverse side of the map. Remove enough of the insulation from both ends of the wire to wrap around each bolt.

The radio battery is wired to the base of the map on the back by running wires at right angles around the battery and through the plaster board. Make a circle about one-half inch in diameter in the extreme lower left hand corner of the board and insert the socket for the lamp.

Connect one of the terminals of the battery with one of the terminals of the lamp socket. On the other terminal of the battery, connect one end of a piece of wire which is long enough to reach

all of the bolts in the rows at the right side of the front of the map. To the other terminal of the lamp socket, connect a wire long enough to reach all the bolts in the lower right hand corners of the specimen squares on the front of the map.

When the ends of both of the free wires are in contact with the two bolts which have been connected, that is, one on the picture of the butterfly and the other on the name of the butterfly, there will be a light.

Get a piece of two- or three-ply cardboard, the size of the plaster board used for the construction of the outfit. Cut out small square holes in the cardboard, to fit over the nuts on the front of the map, as shown in the diagram of the front of the map. Then paste the pictures or the specimens in the square spaces to the left and above the nuts.

The correct names of the butterflies or other specimens used should be typed or printed on small pieces of gummed paper, which may be pasted immediately to the left of the nuts in the two rows at the right. This should be done accurately, and the person constructing the map should test the identifying names to make certain that they correspond, through the wiring, with the specimens mounted in the larger spaces.

The pupil, then, may take one of two wires in each hand, place one on the nut at the corner of the specimen which is to be identified and, with the other, search among the labeled nuts at the right for the names of that specimen. When the correct name has been found and the two free wires are placed on contact with the nuts, there will be a light, as the circuit has been completed.

The electric map has been found to be a valuable aid in learning the names of objects, specimens, pictures, etc., as well as an effective device for testing such knowledge. In testing, students should be rated according to the number of attempts or trials required before proper identification of each specimen.

Photographs and Prints

The first development of photography was a device for recording a still picture—an ordinary photograph. The photograph has been and remains one of the most readily accessible, economical and effective of visual aids to instruction. It is abundantly available and extremely useful. Its effectiveness is attested by its extensive use in advertising, periodicals, newspapers, texts, and all other printed materials and exhibits which are designed to attract and inform.

Pictorial materials, such as photographs, prints, magazine illustrations, post cards, illustrations in travel literature, and the like, are so abundant and so inexpensive that no teacher should be without a liberal supply, particularly for teaching the various phases of the social sciences. Such magazines as *The National Geographic** and the various nature study magazines contain illustrations which are carefully selected, accurately printed, and pertinent.

TEACHING WITH PICTURES. Pictures may be applied to teaching situations by the teacher or by the pupil. In many instances, the teacher will find a simple print to be much more effective in presenting a lesson than many minutes of discussion. The chief limitation of unprojected pictures is that they are difficult to use during a regular recitation period, unless the teacher is fortunate enough to have one for each member of the class. Usually it is advisable to incorporate the picture into the study period, although very good results have been obtained by passing pictures from one pupil to another in an orderly manner.

Pupils may use pictures effectively in connection with presentations of various kinds. Ordinarily, the class recitation with which the pupil can use one or more carefully selected pictures is of much greater interest and value to both the performer and the listeners.

Two simple criteria to be observed in selecting pictures for either pupil or teacher use should be to employ only pictures which pertain to the subject and only enough pictures to illustrate the point clearly. Pictures which do not pertain to the subject are apt to detract seriously from the topic under consideration and an abundance of pictures introduced into one lesson is apt to confuse the minds of the pupils leaving a mottled rather than a clear and desirable impression. Frequently, one or two carefully selected pictures will be sufficient for an entire recitation.

Pupils should be given plenty of time to study pictures. Some pupils comprehend much more readily than others, so each should be permitted to consider each picture at his or her own rate.

Pictures have been found to be highly effective when used to illustrate notes or as a part of a scrap-book for any given course. Pupils should be encouraged to use pictures in this way, including such drawings as they might desire to construct in explanation of points of discussion.

*National Geographic Society, Sixteenth and M Streets, Washington, D. C.

OPAQUE PROJECTION OF PICTURES. One of the most desirable ways to use pictures for classroom instruction is to project them to a screen, by means of a reflecting or opaque projector. Almost any picture of reasonably small size can thus be projected before the group and studied, even including illustrations in texts. The apparatus required for this type of projection is described in detail on page 44, and its possible uses and limitations are noted.

MOUNTING PICTURES. Many pictures are wasted due to improper mounting or care. Many other pictures have their potentialities wasted due to the fact that they have not been arranged so as to be convenient when needed. Either situation is unfortunate and rather easily corrected, if the teacher will but spend a little time in the preparation of materials.

Pictures which are permitted to remain in magazines, pamphlets, or folders are comparatively inaccessible. Furthermore, they are easily damaged in handling. It is usually preferable, therefore, to remove such pictures from the publications and mount them on substantial card or mounting board. The process is not expensive and will add to the accessibility of materials. For example, if a single issue of *The National Geographic* contains air views of the cities of Europe, pictures of French and Spanish Morocco, illustrations of interesting spots in Belgium, and possibly a number of interesting scenes of Russian life, these are all within a single cover and accessible but to one or two pupils at one time. It may be that one will be interested in Belgium, while another will want information concerning the cities of Germany, and still a third will want to study Russia. If the pictures remain within the magazine, one must wait for the other. On the other hand, if the pictures are removed from the magazine, mounted properly, and filed in an accessible manner, each will be able to have his or her material at the same time.

One of the chief difficulties encountered in the mounting of pictures has been that of fastening the pictures to the mounting board in a permanent manner, without damaging the pictures. The majority of the ordinary forms of paste and mucilage tend to wrinkle the picture or cause it to bend out of shape when the paste is applied. A similar reaction occurs when it is applied to the mounting board —the picture curls one way and the board bends the other. The mounting must be done quickly and the mounted pictures placed under a press or weight to flatten them as they dry. If any of the

paste or mucilage goes astray on the face of the picture or on the edge of the mounting board, it causes a serious stain.

These difficulties can be eliminated by using a very simple and inexpensive type of adhesive. It is only necessary to go to the nearest drug store or stationer and purchase a small can or tube of clear rubber cement. Usually, a small bristle brush is furnished for convenience in spreading the cement. If not, any small, stiff brush will be satisfactory.

The technique for using rubber cement to mount pictures is very simple. If the card board on which the picture is to be mounted is 8½x11 inches in size and the picture approximately 6x9 inches in size, a space on the mounting board approximately 6x9 inches in size should be coated with a thin layer of the cement. The back of the picture should be coated similarly, and both should be permitted to dry—the drier they become, the tighter they will stick when put together. After both surfaces—the back of the picture and the front of the mounting board—have become thoroughly dry, place the picture in position on the mounting board and press down firmly with a soft cloth or with the hands. The picture will adhere firmly and will so remain indefinitely.

The use of rubber cement for this purpose presents many advantages, three of which are especially worthwhile. In the first place, neither the picture nor the mounting board will warp or bend when the cement is applied. Both will remain flat and will join without any tendency to fold, wrinkle or warp. Secondly, it is not necessary to rush the process of mounting and an interruption during the process has no disastrous effects whatever. If the person mounting pictures in this way should receive a telephone call, a caller, or should find it necessary for any reason to leave the material for a time, the extra drying of the cement on the picture and on the mounting board will but cause it to adhere more firmly. The third great advantage is that the mis-application of some of the cement to the surface of the picture, or on the uncovered edge of the mounting board causes no damage to either. It is only necessary to rub off the excess dried cement with a clean, soft cloth. Actually, the removal of excess cement in this way will tend to clean the surface of the picture and mounting board, rather than to damage or stain it in any way.

Mrs. Charles Joe Moore, Secretary of the Bureau of Visual Instruction, University of Texas, has developed a very interesting use of cellophane to protect the surfaces of mounted pictures. The cello-

phane is cut in sheets slightly larger than the card upon which the photograph is mounted. It is placed over the front of the picture and the protruding edges of cellophane are folded back of the mount and cemented there. Thus, finger prints and dust accumulate on the cellophane rather than on the photograph, and may be removed with a moist cloth.

FILING PICTURES. Proper filing of pictures must be preceded by proper mounting. If the pictures or mounts are of many different sizes, it will be extremely difficult to arrange any system of filing which will be truly satisfactory. The size of the mounting board should be determined by the size of the space available for filing the pictures. If no special size has been determined, two sizes which have been found to be very satisfactory are 5x7 inches and 8½ x 11 inches. These two sizes will accommodate the majority of the pictures available for mounting, and there are many filing cabinets for these two standard sizes. The mounting board should be stiff enough to support itself in vertical position, but not so stiff that it will be cumbersome to handle.

After pictures have been collected from various sources and mounted properly, they should be made accessible to both teacher and pupil with the least amount of inconvenience. In some instances, it may be preferable to arrange the pictures in groups or sets, filing these sets in special envelopes, packets or folders. Usually it is advisable not to include more than twenty to twenty-five in one group, as a very large assortment will have a tendency to confuse rather than to instruct.

Inasmuch as many pictures may serve for more than one purpose, i. e., for geography, nature study, history, etc., it is sometims advisable to use a number system of filing, with a control card. A picture of Old Faithful geyser, with only one print available, might receive the number, 75, and this number might be placed on control cards for geography, natural science and elementary geology. In this way, pictures might be thoroughly cross-indexed and used frequently among different classes.

Each picture should have a name by which it can be classified, regardless of whether or not the number system of filing is used. In most instances, the name will be the only necessary identification, and the numbering will not be necessary. However, the name or the name and number should be printed clearly in the upper right or left hand corner of the picture as it will be placed in the file. The identification can be either hand lettered on the mounting card, or

typed on a piece of gummed paper and stuck on the card. It is sometimes advisable, also, to indicate the subject for which the picture is best suited, providing an arrangement similar to the following:

75. Old Faithful Geyser, Yellowstone National Park

GEOGRAPHY
North America

Identification and divisions can thus be made by continents, nations, regions, states, etc., as may seem desirable.

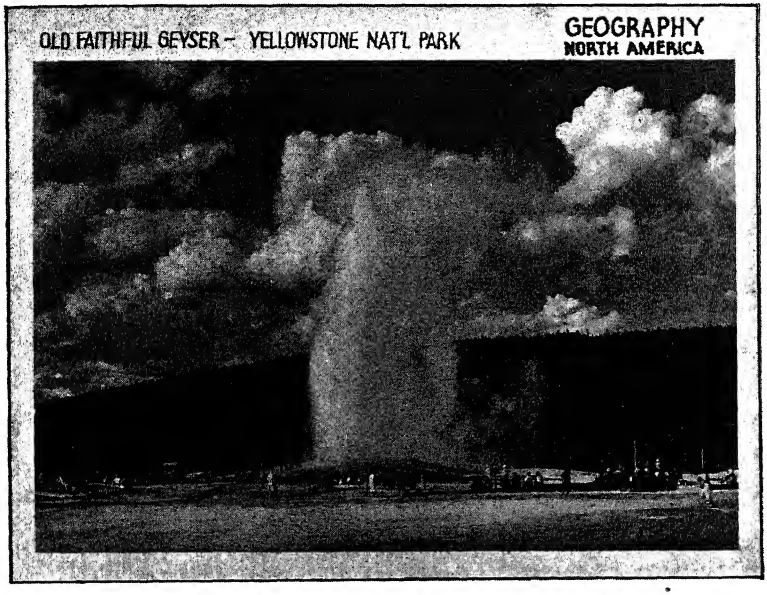


Photo Courtesy U. S. Department of the Interior

Once the filing order is determined—alphabetical or numerical—the pictures should be kept in that order at all times when they are not in use. Carelessness in filing causes inconvenience and waste of time in locating the pictures, thus decreasing the potential value of the material. Pupils can be taught to replace materials properly and the training will be valuable to them in later life.

DISTRIBUTION OF PICTURES. If an assortment of pictures has been prepared by a teacher for use in her own subject or room, the problem of distribution does not enter. On the other hand, it is

sometimes desirable to centralize the picture collection and make it available to all teachers who might desire to use it. The problem of distribution becomes, then, one of the matters to be given careful consideration. It has been found that when materials are distributed without proper records for checking, much of the material soon becomes lost and the service is impaired. All teachers may be honest, but some are careless and careful checking is required.

If the clerical help available is sufficient to permit the pictures to be filed and distributed individually as requested by the teachers, it would be preferable to do so. If such assistance is limited, it will prove economical to arrange the pictures in groups—carefully classified—and loan them to the teachers as units. The teacher may not want to use all the pictures in a group, but can select the desired ones, use these, and return the complete assortment at one time. As suggested above, it will be desirable to limit the size of any one group of pictures to twenty or twenty-five, as it is seldom that more than that quantity of pictures can be used effectively in connection with a study or recitation period.

SPECIAL SETS OF PICTURES. Many organizations or agencies offer mounted and unmounted pictures and picture sets for sale. Some have been well organized and carefully selected. Others are simply in miscellaneous arrangement and must be selected and classified by the purchaser. There have been, however, some notable developments in the selection and organization of photographs for educational purposes. The list of picture sources on page 202 should be helpful.

HISTORICAL PHOTOGRAPHS. One of the most unusual and most useful services of this type has been developed during the past few years, in Hollywood. It is merely an adaptation of valuable pictorial materials to educational purposes, for which the producers deserve much credit.

In Hollywood, millions of dollars have been spent in research and reconstruction—research to determine the proper setting for historical dramas of all periods and the reconstruction of scenes for the production of those dramas. As the motion pictures are "shot," still photographs are taken by expert cameramen. Some of these "stills" have been used for advertising purposes, but many of them have remained in negative files, unused. The majority of these pictures are as accurate, historically, as it is humanly possible to make them. These should be, therefore, valuable aids to those his-

tory teachers who may desire to bring true pictures of the past before the pupils of today; who desire to vitalize instruction by taking the pupil on a pictorial journey to the places and through the times about which he may read in the text and reference books.

A group of far-seeing and enterprising educators along the western coast has undertaken the job of organizing this vast storehouse of accurate and highly educational photographs into sets for instruction in history. The firm, Photographic History Service,* has been organized to handle the details of production and distribution. Sets of pictures by the following titles are now available for distribution:

Ancient Egyptian Life
Roman Life
Feudal Life
The Vikings
Elizabethan England
French Revolution
Arabian Desert Life and Culture
Russian Life (up to the Soviet)
The Pilgrims
American Revolution and Origin of Goverment
Daniel Boone Frontier Life
Westward Movement
Slave Life and Abraham Lincoln
David Copperfield

The sets of historical photographs average fifteen pictures each, and are boxed in durable cartons of convenient size and shape for handling or filing, or in bound volumes for reference table or library use. The photographic prints are 8 x 10 inches in size, mounted on durable cards 9¼ x 11 inches in size. There is a full descriptive text below each picture. Other valuable accessories are included with each set, as explained in the announcement of Photographic History Service explaining the reason for offering the pictures in sets rather than individually.

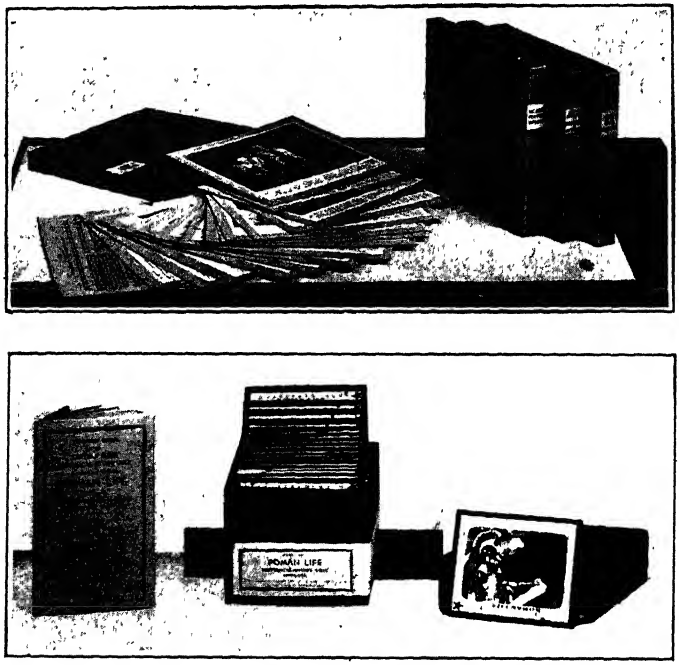
"These units were prepared to visualize the fact that life is a series of experiences, each of which is a cause or an effect of one of the others. Therefore, we have grouped and prepared them so the dramatic significance of the period would spring to life and the student or casual reader could enter into these people's daily lives and gain a balanced visual understanding of how they acted and

*Photographic History Service, 5127 Franklin Ave., Hollywood, California.

why they succeeded or failed, thus making history dynamic and full of meaning for him.

"When this material was made available to us, many conferences were held with librarians, visual directors and historians covering the high points of each period, it was unanimously decided that the minimum number required was fifteen; that, in addition, a concise introduction was necessary to lay the proper background with a text under each picture to accentuate the principal points and broaden the subject; and for classroom use, a teacher's question guide to aid in bringing out a wide discussion."

Sets of the pictures are available, also, in easel-type bound volumes, prepared especially for the browsing table in school or public libraries. In addition to preparing the sets of pictures and accessory materials for classroom and library use, Photographic History Service is now offering the same sets in glass slide form, accompanied by suitable explanatory material and other teaching aids.



Photos Courtesy Photographic History Service

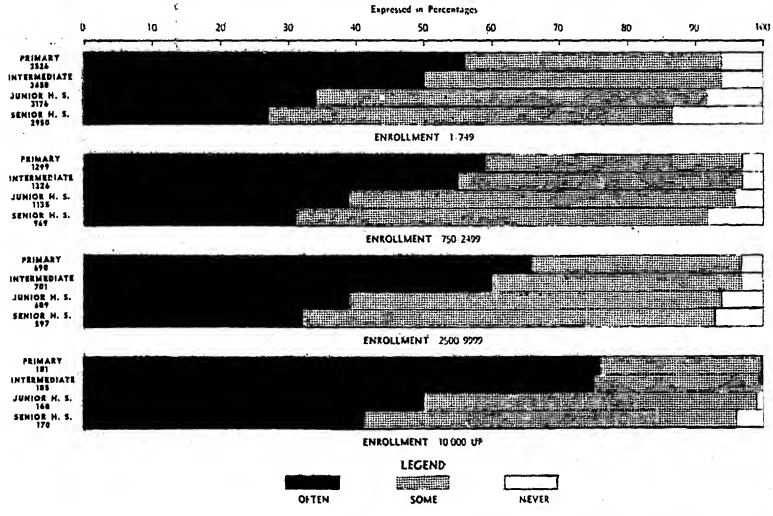
Mounted Pictures and Duplicate Glass Slides, with Manual

GEOGRAPHICAL PICTURES. Another excellent series of pictures prepared especially for school use in the teaching of geography is offered for distribution by the National Geographic Society. The various pictures are grouped into what is known as the Pictorial Geography Series, including the following divisions:

No. 1—Eskimo Life, and Sahara Life (48 pictures).
No. 2—The Indian in America, and The Negro in Africa (48 pictures).
No. 3—Life in China, and Hill Tribes of the Philippines (48 pictures).
No. 4—Land, Water and Air (48 pictures).
No. 5—The United States, General (48 pictures).
No. 6—Italy (48 pictures).

The pictures have been selected from the various issues of The National Geographic, so vary in size. However, the pictures and accompanying descriptive material are printed together on light weight cards, 9 x 11 inches in size. The sets are available at very reasonable cost.

EXTENT TO WHICH
MOUNTED PICTURES
ARE USED IN PRIMARY AND SECONDARY SCHOOLS



Graph Courtesy Office of Education (1936 Survey)

The descriptive material which accompanies each picture is prepared in simple language, so it may be read with understanding by pupils in the earliest geography and nature study classes.

In addition to this service, the National Geographic Society offers color sheets reproduced from various issues of the magazine, covering nearly every country in the world. These color sheets are printed on the usual magazine paper stock and are excellent for mounting purposes. In many cases, there will be pictures on both sides of the sheets, so it will be desirable to order two copies or sets of each. The color plates are furnished at 30c for 48 sheets or at 50c for 96 sheets, to be selected in small groups from a very large list of available subjects.

Another service of the National Geographic Society which should be of value to all schools is offered in the form of attractively bound books on fishes, birds, cattle, horses, wild flowers, wild animals, and Washington, D. C. Complete information concerning this service will be provided upon request.

The Opaque Projector

The opaque projector is an instrument which projects by reflection pictures, diagrams, and other flat or near-flat surfaces, enlarged for group consideration. It has many advantages, and certain limitations, which should be given consideration by those who desire to use photographs, prints, diagrams, and the like for classroom instruction in the most effective manner. The average opaque projector for classroom use ranges in price from $75.00 to $110.00 depending upon the type selected and the completeness of the instrument. It is light in weight and may be moved from room to room with ease.

ADVANTAGES: The greatest advantage of the opaque projector is that it will project almost anything to a screen for group study or consideration. Furthermore, the pictures thus projected are reproduced accurately as to color. A color plate from the National Geographic Magazine, for example, may be placed in a good opaque projector and enlarged upon a suitable screen to almost any desirable size, without damage to the picture.

This leads, logically, to the extreme economy of the opaque projector. Materials for use in it may be collected from hundreds of sources, including books, magazines, post cards, travel bulletins, catalogs, or nearly anything which has in it an illustration worthy

of class consideration. Ordinary typed material, drawings, diagrams, and graphic presentations of all kinds may be used in it quite satisfactorily. Although pictures in books and magazines may be projected without removing them from the books or magazines, it is usually more convenient to mount the pictures on cards. They can be handled more easily and will be available for individual study when desired.

A great advantage of the combination projector for opaque projection and for the use of glass slides is that the change from one to the other may be made almost instantly. It is possible, therefore, to supplement available glass slides with reflected pictures which the teacher might select for special teaching situations.

It is possible, also, to secure a filmslide attachment for the opaque projector but usually desirable to secure a separate filmslide projector, in order that the two units might be used simultaneously in different parts of the building or school system. A filmslide attachment costs $38.50 and the separate filmslide projectors range in price from $15.00 to $48.00, so the inconvenience of the attachment is not offset by a comparable saving in cost. Accordingly, it is recommended that the separate and more convenient filmslide projector be used.

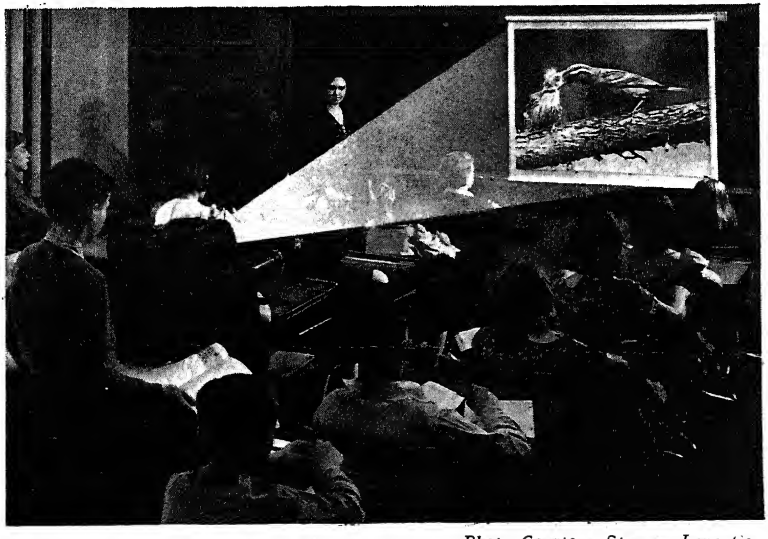


Photo Courtesy Spencer Lens Co.

Opaque Projector in Classroom Use

LIMITATIONS: Although there are many points in favor of the opaque projector, there are some limitations which should be mentioned. The greatest, perhaps, is that a rather thorough darkening of the room is necessary for opaque projection. Since the picture is reproduced by reflection rather than by passing a light through the picture—as in the projection of glass slides—much of the light is lost. If the room in which the projector is to be used can be darkened thoroughly, the result will be highly satisfactory. In some of the older school buildings, the matter of darkening brings into consideration the problem of ventilation. The newer buildings, with centralized and controlled ventilation, have eliminated this problem.

Another limitation, relatively unimportant, is that the opaque projector is more cumbersome to take from place to place than is the glass slide or filmslide projector. Although this is true, the weight of the newer types of opaque projectors for classroom service has been reduced to the point where any pupil in the upper grades or any teacher can take the projector from place to place with ease.

Some of the older type opaque projectors damaged some of the materials being projected, particularly if the pictures were highly colored. The leading manufacturers of these projectors* have solved that difficulty by providing suitable ventilation for the smaller projectors, augmented by cooling fans in the more powerfully illuminated units.

The Stereograph and Stereoscope

The stereograph is a picture which produces the impression of the third dimension, depth. The pictures on the stereograph are taken with a two-lens camera, approximating the views on the retinas of our eyes as we look at any object or scene. We look at these two similar pictures through a stereoscope or telebinocular and are given the impression of depth, much as though we might be viewing the same object or scene in its natural setting. Although it is an artificial creation of the third dimensional effect, the stereograph gives us the nearest pictorial approach to the object itself in its natural setting. The observer really sees one picture with the left eye and another with the right. The right eye sees more of

*For information concerning opaque projectors, write to the companies mentioned on page 202.

the right side of the object and the left more of the left side. The sense organs put the two pictures together and we see the whole object, thus giving the impressions of solidity and relief.

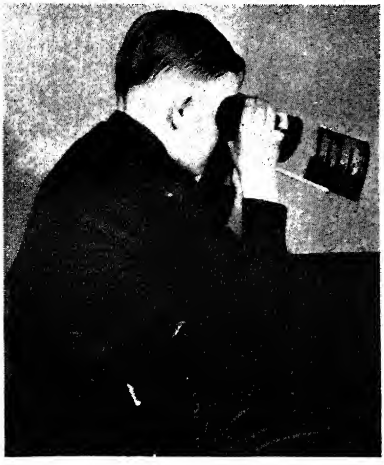


Photo Courtesy Keystone View Co.
Using a Stereoscope

"The stereoscope itself is an optical instrument with a similar pair of lenses separated by a small wooden partition to keep the right eye from seeing the left view and the left eye from seeing the right view. These lenses are arranged within a hood which fits over the eyes and tends to shut out the light and other possible distractions. When the stereograph is seen through this binocular instrument an impression of depth, or the third dimension, is received. This gives charm and educational value to the picture, as it creates an illusion of reality and seems to transport one actually into the pictured situation. 'We see something with a second eye and the mind feels its way into the very depth of the picture, around the object, and gets an idea of its solidity,' says Oliver Wendell Holmes, who perfected this remarkable device.

"The stereograph is, therefore, a photograph of an actual situation in life, not an artificial creation or stage setting built up for a special occasion. The lens of the camera in this case acts as an unprejudiced, mechanical eye. In studying a great painting we are able to see only what the artist visualized and reproduced on his canvas. The study of the stereograph is almost unlimited. Each time it is viewed some interesting detail far off in the distance is revealed.

"Through these interesting devices the great wonders of nature in the remotest parts of the earth are brought truthfully and vividly before us, and great personalities of history, like McKinley, or Roosevelt, or Wilson seem so real that we almost expect them to open their lips and speak. This element of truthfulness brings joy and delight to both old and young."*

*Dorris, Anna V, "Visual Instruction in the Public Schools."

ADVANTAGES: The stereograph, as suggested above, presents to the pupil a more nearly true concept of the object, person, or situation than could be obtained through the use of any other type of picture. The pupil is actually transported to the place where the picture was taken and sees the picture with a sense of being present.

The stereograph is inexpensive, costing only about 21c for each view. Furthermore, there is an unlimited supply of excellent stereographs available. One large organization† has devoted many years to the preparation of stereoscopic views of all parts of the world, including many excellent pictures for nature study of various types.

LIMITATIONS: The stereograph is an individual rather than a group teaching tool. Furthermore, it is sometimes difficult for students with defects of vision to receive the third dimensional impression. This is an unusual situation, however, and in some instances the proper use of the stereoscope will aid in correcting defects of vision.

HOW TO USE STEREOGRAPHS. "The stereograph gives a conception of reality that is not given by any other picture. The third dimension gives actuality of form and a strong feeling of intimacy. Its impression on the pupil is tremendous. He feels that he is a part of the pictured situation. It lends itself particularly to individualized work. Only one pupil can see it at a time. To the keen teacher and supervisor, this is not a handicap but an asset. It makes necessary an emphasis of the individual aspects of education that have been so much neglected. Each pupil sees his own relationship to the pictured situation and brings to the class discussion his own thoughts on the subject. Through vivid presentations we are here cultivating original thought, favorable attitudes and habits of active participation. No commonly practiced visual activity of the school can compare with that of a pupil closed off from the rest of the world by the hood of the stereoscope, lost in the contemplation of the realities of the stereograph.

"These realities, of course, just deal with the subject matter of the lesson at hand. The stereograph is most effectively used as a part of the study period in which definite problems are assigned. If the geography class, for example, is engaged in the study of anthracite coal mining, a number of views can easily be obtained that help give a concrete basis for class work. This is the one important

†The Keystone View Company, Meadville, Pennsylvania.

purpose of the stereograph—to build backgrounds of definite conceptions and interest that will make study effective.

"The stereograph furnishes intensive ideas. Its great values are its vividness and impressions of reality. The child gets strong impressions of acquaintanceship with the situation he sees in the stereograph. Everyone remembers scenes depicted in stereographs he saw long ago. These facts are at the bottom of the educational urge to make a larger use of stereographs in education. At the same time, a careful analysis of these possibilities makes reasonable the suggestion that only a few stereographs, rarely more than one or two, should be presented at a time. In this way, vivid impressions will not submerge each other and the whole activity become confused, nor will the child get only the superficial and fleeting ideas that so often characterize his reactions to educational pictures of other types. To the stereograph can well be delegated in educational procedures the responsibility of conveying one definite and vivid impression at a time.

"Let us suppose that a half hour is set aside for the study of the geography lesson. The class is studying about Japan. Certain references have been assigned for reading in connection with problems raised in a previous class period. The teacher has decided a certain two stereographs would be helpful. A pupil may be assigned to get these two stereographs from the cabinet. After inspecting them briefly and confirming her opinion that they will be helpful, the teacher puts them in stereoscopes and lets them pass around the room from hand to hand in some predetermined order. This is a matter of day-by-day practice and routine.

"While two pupils are looking at these views, the rest of the pupils are continuing their reading and study. Each member of the class in his turn inspects these two stereographs which contribute greatly not only to his actual information on the subject but also to his attitude toward it. Each pupil spends less than one minute looking at both the views, one half minute to each. This will permit 60 pupils to see each view during a 30 minute study period. This is a greater number of pupils than the average teacher has to deal with in a study or recitation period. The class as a whole hasn't changed its normal procedure at all. And yet the whole activity has been marvelously vitalized by the real visual contacts each individual has had with the subject matter in question.

"This procedure can be varied as local conditions require. Some teachers prefer to have the views placed on a reference table and

used by each pupil in turn as opportunity permits. The use of the stereograph need not be confined to the study period in which it functions definitely. It is difficult, however, to devise a simpler and more convenient, more effective method to use than the one described above.

"The stereographs may be used in the library by individuals, just as any other reference material is used. The views may be included in the lesson assignment or the pupil may be encouraged to look up his own references. The individual use of the stereograph is most valuable, always, when it is followed by the group use of the lantern slide in class. A most effective use of stereographs is to assign to individuals definite stereographs to study, with a view to reporting with the aid of the duplicate lantern slide during the class period. Let us suppose that a study of cotton has been undertaken by the class. John and William are told to use a certain stereograph and to be prepared to report and show the corresponding slide at tomorrow's session. Mary and Betty are to report an another stereograph, and so on. Here again, the stereograph affords vivid and strong backgrounds for a real interest and attitude toward the subject and an appreciation of its realness and its significance.

Stereographs with Lantern Slides

"Just as the stereograph is fundamentally an individualized type of equipment, vivid and full of meaning for the individuals who see it, so the lantern slide is adapted especially to group activity. Individual study should not proceed while lantern slides are being used. We are now in a socialized activity. Here is where one gets the pupil's reaction to complete preparation strengthened by the use of duplicate stereographs.

"Where stereographs are used from day to day, there is no use of the lantern slides that can compare with the review recitation. A record has been kept of the stereographs that have been used, let us say, on iron and steel. Now we get the duplicate lantern slides to review and summarize the stereographs which have given the pupils their impression of realness and clearness, and that have furnished such vivid conceptions of the pictured situation that will accentuate the pictorial values of the projected lantern slide. Pictures of scenes with which we are familiar always mean more to us. We put perspective and understanding into pictures of our

summer home, and into the pictures of places that we have visited in far-away lands. Our familiarity with the real places makes the pictures mean more to us than they mean to our friends. The boy or girl, standing at the projected lantern slide with pointer in hand, who has studied the stereograph, is in somewhat the same situation. He sees with eyes of interest and understanding that bring from him spontaneous self-expression and inspire class discussion unparalleled in any other situation.

"Stereographs are a wonderful aid to study and give the individual pupil an unusual conception of the subject matter under investigation. But these vivid individual impressions and definite conceptions become infinitely more valuable when they are expressed in spoken language and discussed by a group. It is thus that facts and principles are fixed. The duplicate lantern slide is by all odds the best means of clinching fully the impressions and of bringing out the implications of the knowledge gotten by the individual from the stereograph."*

The Glass Slide

The ordinary glass slide of American standard is 3¼x4 inches in size, and fits all the common slide projectors. It is usually composed of four or five parts; (1) the slide plate, or glass on which the picture has been printed, (2) a mat or mask, to keep the dimensions of the picture within the size of the aperture gate of the projector, (3) a cover glass, to protect the emulsion or picture of the slide plate, and (4) the binding tape, which is used to fasten the plate and cover glass together firmly and prevent dust or moisture from getting between and damaging the picture. The fifth part may be a piece of cellophane, a paper cut-out (silhouette), a piece of Lumarith, a piece of thin paper, or a photographic positive on which a picture or outline has been drawn or printed for projection. In such cases, two cover glasses are used to protect the material, in place of the usual slide plate and a cover glass.

There are many variations of the above to meet different situations and conditions in which the slides are to be used. The glass slide has become one of the most useful visual aids and is being adapted to new purposes from year to year. No other type of projected visual aid can equal it in quality of the projected image or in adaptability to a wide range of uses. An attempt will be made,

*Hamilton, George E., "How to Use Stereographs and Lantern Slides. Reprinted from The Educational Screen, November, 1926.

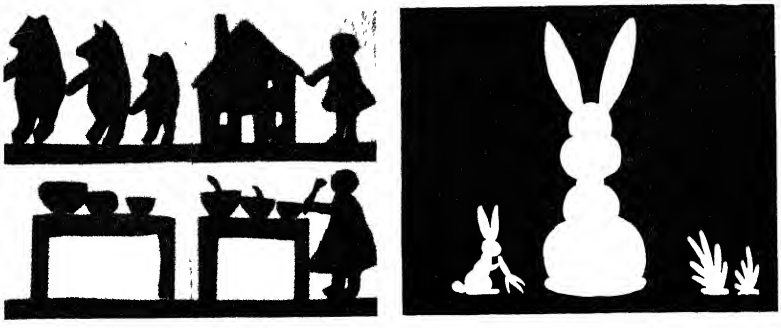
in the following discussion, to call attention to the various types of glass slides and their many possible uses.

Types of Slides

PAPER CUT-OUT LANTERN SLIDES. Children in the primary grades may make their own lantern slides to illustrate such stories as "The Three Bears," "The Boy and the Goat," etc. Let the children cut out pictures free hand, using light weight black paper, or any other paper which will prevent the light of the projector from passing through. Then select the best cut-outs and let the children paste them on ordinary cover glass. This gives a silhouette effect when projected on the screen.

The illustrations on this page will indicate something of the types of silhouette slides which may be prepared by pupils. These pictures carry a definite message which contributes materially to the subject of study. The spirited enthusiasm among the pupils who are permitted to make these slides and project them before the class is certainly evidence strong enough to warrant the use of such materials whenever possible.

ETCHED GLASS SLIDES. There are three principal kinds of etched glass slides. First of all it may be well to explain that etched glass is simply a piece of glass of high quality, one side of which has been roughened or etched by the use of acid or by some other method. This roughening of the otherwise slick surface of the glass provides a surface which may be used for pencil outlines or crayon work, neither of which would be satisfactory on the smooth glass.



Photos Courtesy Society for Visual Education, Inc.

Paper Cut-out or Silhouette Slides

There are numerous advantages to the etched glass slides, particularly in those cases where the material on the slide is to be used but once or for a short time only. In the first place the etched glass may be used over and over again as the pencil or colored outlines on it may be removed with soap and water or with a solvent for the colored ink, leaving the surface just as clear as it was before use. In the second place, the ease with which the etched glass slide may be used for pencil outlines causes it to be one of the preferred types for rapid work in slide making. Another convenience of the etched glass slide is that it need not be protected with a cover glass unless it is to be kept for permanent use. It is extremely important that high quality etched glass be used for the best results, and the best slides cost approximately 10c each.

ETCHED GLASS SLIDES USING COLORED PENCILS. One of the simplest types of pupil-made lantern slides is made by using a special water color pencil on finely finished etched glass. A set of six colored pencils will cost but fifty cents and may be used for producing hundreds of slides.

The following suggestions will be helpful in making etched glass slides.

1. If the picture to be reproduced is a free-hand drawing, it is advisable to draw it first on a piece of paper, 3¼x4 inches in size. If a picture is to be reproduced and is less than this size, it will not be necessary to make a sketch of it. If the picture is larger than the slide size, it is usually possible to select the important part of the picture and use it. The details of the picture should be kept within a space approximately 2¼x3 inches.

2. Lay the piece of etched glass on the drawing or picture and trace the details in outline with an ordinary medium or hard lead pencil. Mistakes in pencil marks may be removed with art gum

3. Color the picture with the lantern slide pencils.

4. If it seems desirable to preserve the picture for future use, place a piece of plain cover glass over the colored drawing and bind the edges with lantern slide binding tape. A piece of tape fifteen inches long is required to bind the glass all the way around. Wet the tape. Place it on a flat surface with the sticky side up. Hold the two glasses tightly together and place on edge in the middle of one end of the tape. Turn the glasses along the tape, being sure the edges are being kept in the middle of the tape, which will stick to the glasses. Then press the edges of the tape over the edges of the glasses and they will be bound securely.

If the slide is not to be used again, it will not be necessary to use the cover glass or the binding tape. Furthermore, the pictures may be removed by using a little Dutch Cleanser or similar washing powder with water, or by using a lead pencil eraser on the dry glass. A small bristle brush will be helpful if the slide is washed.

ETCHED GLASS SLIDES USING COLORED INKS. The chief advantage of the slides made with colored inks, over the slides made with colored pencils, is in the brilliance of the coloring. By thining the lantern slide ink with water, beautiful light variations of the six colors may be obtained. Furthermore, these colors may be mixed to form any desired shade or tint. An assortment of six colors of lantern slide ink may be purchased at a cost of $1.50.

It is possible to use the lantern slide ink on plain glass. The ink adheres to etched glass better, however, so it is recommended that the etched glass be used in most cases. Inasmuch as the colored lantern slide ink is more difficult to use than the colored pencils, it is recommended that the ink slides be made by advanced students or by the teacher. If the slides are not to be used again, the pictures may be removed by using ordinary soap and water.

The usual procedure to be followed in making ink slides on etched glass would be approximately the same as for making the pencil slides. A small brush or pen should be used to color the outlines of the picture. If the ink seems too thick or too dense, thin it with water.

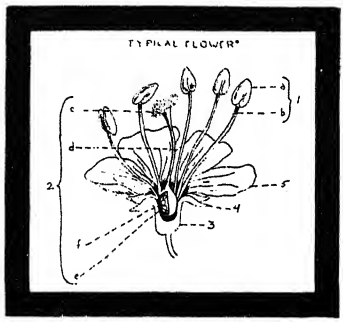
A second grade class was studying "The Science of Spring". One of the activities which grew out of the unit of work was to make lantern slides of 15 different birds they had observed and studied. They used the colored inks, and made them according to the directions for making slides using the colored pencils. Some of the lantern slides were of the red-headed wood pecker, red-winged black-bird, cardinal, blue jay, meadow lark, robin and blue bird. Only the most prominent colors were painted on each bird. The unit of work was finished by giving an assembly. As each slide was projected on the screen, a pupil gave a report of the different things learned about the bird.

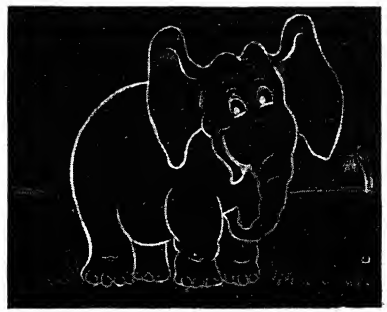
CERAMIC PENCIL SLIDES. The ceramic slide is a type of lantern slide which the children in the primary grades may make most successfully. Either cover glass or etched glass may be used, although the etched glass is more satisfactory. Cover glasses must be absolutely free from dust and corrosion or the pencil will skip

across the surface without leaving an impression on the glass. It is possible, however, to coat ordinary cover glass with a thin emulsion of clear shellac to provide a surface on which one may write with a ceramic pencil, with India ink, or may tint with water colors. The shellac can be obtained at any drug store in small quantities, and should be thinned to about one-half the usual consistency.

After the slide thus made on the shellacked cover glass has served its purpose, it is very easy to dissolve the shellac and wash off the picture with industrial alcohol or any of the other common solvents. Then the cover glass may be coated again and used for making another slide.

INDIA INK LANTERN SLIDES. Ordinary cover glasses may be used for the India ink slides. It is necessary, usually, to wash the slides thoroughly with soap and water in order to remove any oil or other matter which may not permit the ink to stick to the glass. A thin coating of clear shellac may be used advantageously, also. There is a special pen point which is used for writing on glass, but usually any point which the pupil or teacher can use well on paper will be satisfactory.





Photos Courtesy Society for Visual Education, Inc.

An India Ink Slide A Ceramic Pencil Slide

Outline maps of states or countries may be made with India ink for use in classes in geography, history or social sciences. Then they may be projected upon large sheets of manila paper fastened upon the blackboard or wall. While it is projected upon the paper, an outline of the map may be made with crayons or paints. Products, cities, points of interest, life of the people depicted by free hand drawings or clips may be located by different pupils or the

entire map may be painted with calcimine paint to show valleys, mountains, etc. A detailed master slide might then be used for checking the accuracy of the work of the pupils.

In primary activities, in the study of "Farm Animals" or "Animals of the Circus" the same procedure may be followed. This type of work is particularly valuable in training pupils of these grades in the use of the larger arm muscles. There is no limit to the uses of the India ink lantern slide. Both teacher and pupils will find new occasions for making them each year. The slides may also be preserved from year to year. A library of inked slides which have been made by both teacher and pupils may soon be accumulated for use in each of the different subjects.

CELLOPHANE LANTERN SLIDES. The cellophane lantern slide is made by slipping a small sheet of cellophane, 3¼x4 inches in size, into a folded sheet of carbon paper and then typing on the cellophane sheet, through the carbon paper. If the typewriter does not give a good, clear impression on the cellophane sheet, remove the ribbon to permit the bare type to strike the carbon paper, as when cutting stencils.

The copy should be planned carefully and typed on paper, confined to a space approximately 2¼x3 inches in size, before an attempt is made to type it on the cellophane. In that way, the appearance of the slide may be made attractive by the use of proper spacing and arrangement of items to be included. It will be best to confine the copy to thirteen lines of single space typing with thirty-two or thirty-three spaces to the line. The typing should begin at least one-half inch from the top of the cellophane sheet and three or four spaces from the left edge.

The typed cellophane sheet is then separated from the carbon paper and bound between two pieces of plain lantern slide cover glass. The binding tape may frame it entirely, or a small piece of tape on each edge will hold the glass firmly, if the slide is not to be preserved for future use. Hand-written material, drawings, tracings, etc., may be imprinted on the cellophane sheets in a similar manner also, by using a hard pencil or a stylus.

The cellophane slide is a valuable teaching tool in the hands of the busy teacher. All sorts of reading exercises, outlines, and other matter, usually printed or written on the blackboard, may be put on such slides and kept for repeated use. Furthermore, pupils in the intermediate and advanced grades, including those in high school and college, may use the cellophane slides to good advantage

in preparing reports and classroom discussions. The materials used are inexpensive and the results of their proper use are limited only by the energy and ability of the teacher.

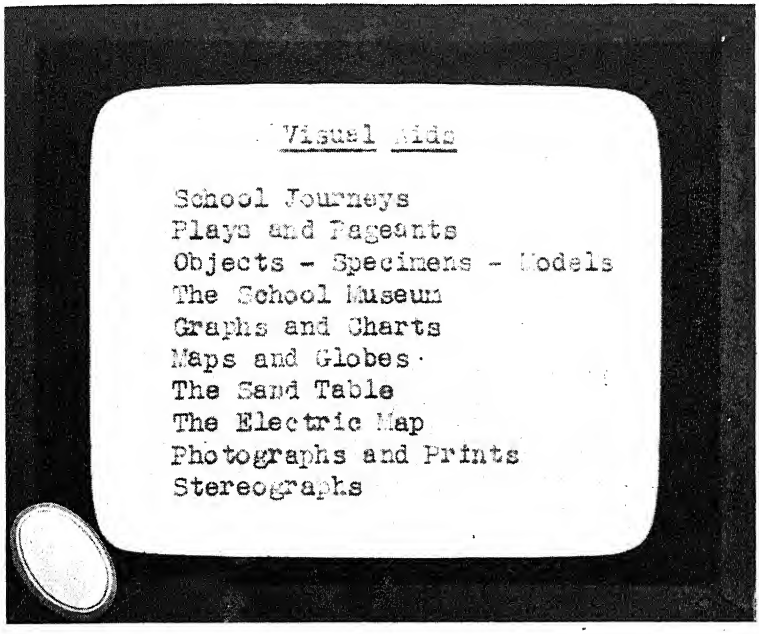


Photo Courtesy RCA Manufacturing Co., Inc.

Cellophane Lantern Slide—Actual Size

It is possible with the medium or heavy sheets of cellophane to trace from drawings or other outlines on the cellophane with India ink. Sometimes it is a little difficult to hold the cellophane in place while the tracing is being made, but this piece of cellophane placed between cover glasses makes a very satisfactory projected outline or diagram. Those who may have an excess supply of cellophane and a limited number of cover glasses may make up a series of slides on the cellophane sheets and simply insert these between two cover glasses which have been hinged with binding tape along one side. In this way two or three pairs of cover glasses will provide equipment to be used in showing a much longer series of the cellophane slides.

On all types of slides, made by either pupil or teacher, a margin of approximately one-half inch should be left around the edges in order that all the typed or written material may be included in the field of projection. When hand lettering or writing is to be done, cross-sectioned paper laid under the glass will provide horizontal and vertical guide lines.

LUMARITH SLIDES. A new material, which has been developed for industrial purposes but which is highly satisfactory for home-made lantern slides, is known as Lumarith. It is produced by the Celluloid Corporation* and the etched Lumarith is quite similar in appearance and convenience to the etched glass. It is made of cellulose acetate, so it creates no fire hazard even when subjected to excessive heat. The material is available only in sheets approximately 20x50 inches in size if ordered directly from the company, and these sheets range in price from 55c to $1.50 in the weights ordinarily used for slide making.

PHOTOGRAPHIC LANTERN SLIDES.† It is extremely difficult to avoid confusion when mentioning the various forms of lantern slides to those who are not familiar with some of those forms. The term "photographic" is used here for want of a better one to designate those slides which are made by transferring images to sensitized glass slide plates. This would include the majority of the slides which are prepared for sale, and many of those which are made by teachers for their personal use. In many cases, advanced pupils derive much pleasure from this type of work and produce excellent results.

The making of photographic lantern slides is a most fascinating undertaking and yet a rather simple process. For the beginner, the following procedure and materials have been found to be very satisfactory. After a few trials, and following directions closely, the technique will be mastered and the results will be highly satisfactory. It is well to use these simple materials until the proper handling of them has been mastered. The materials here recommended are no better, perhaps, than others on the market, but excellent results have been secured by using these, and, after the slide-maker has learned the fundamentals, he may select the materials which he believes will suit his situation best.

EQUIPMENT. The first essential is a dark room. Any room which may be made absolutely dark and which has running water

*Celluloid Corporation, 290 Ferry Street, Newark, New Jersey.
†Hethershaw, Lillian, "Simple Directions for Making Visual Aids." The Educational Screen, 64 East Lake Street, Chicago, Ill.

in it may be used as a dark room. There should be two types of electrical lighting equipment in this room; a Wratten Series "O" or a "ruby" light to be used when handling the sensitized plates; and a frosted 25-watt tungsten lamp to be used in making prints from the negatives. The light switches or controls should be placed on or near the work bench, so they may be convenient at all times.

Two white enameled pans, approximately 6x8 inches in size and 1½ inches deep, will be needed. One of these will be used for the developing chemicals and the other for water. In addition, there should be one large enameled pan, approximately 20 x 24 x 3 inches in size, to be used to contain the "fixer." An ordinary sink or some other form of tank will be needed as a place in which the slides may be "washed" as a part of the process. A simple slide rack, in which the slides may be placed while drying, is essential.

LANTERN SLIDE PLATES. The Eastman or any other "slow" plate is the type which will prove to be most satisfactory for the beginner, as it is less sensitive to light than the other types. The plate is a piece of clear glass, 3¼x4 inches in size, one side of which has been sensitized by coating it with an emulsion composed of silver bromide and silver iodide dissolved in gelatin. The emulsion side is the dull side of the slide. These are packed in boxes of twelve and the boxes should be opened only in a dark room. Furthermore, it is important that the boxes be kept closed tightly at all times except when the room is thoroughly dark or illuminated only by the red light.

NEGATIVES. Any negative which will make a good print will make a good lantern slide. The lantern slide is merely a positive print of the negative used. When making contact prints, it is necessary that the negative be approximately 2¼x3 inches in size, or that the essential part of the negative to be transferred to the glass slide be confined to these dimensions. If materials are to be photographed for transfer to glass slides, it will be well to use a camera which accommodates a negative 2¼x3¼ inches in size. Any size of picture may be transferred to a lantern slide, of course, but the use of the smaller negative will tend to eliminate one or two processes. There are lantern slide negatives on which drawings, photographs, etc., may be recorded, and these same negatives may be used over and over again in the production of additional slides of those subjects. However, the beginner should learn the simpler processes first and the more difficult procedures may be accomplished later.

CONTACT PRINTING. As mentioned above, this is a very easy method for the beginner, and very satisfactory. Simply place the emulsion or dull side of the lantern slide plate against the dull side of the negative from which the picture is to be made and hold each against the other firmly by using an ordinary printing frame, with the plate below the negative. The 25-watt frosted tungsten lamp should be suspended about six feet above the work bench and, after the negative and plate have been fixed firmly in place, should be snapped on for about 15 seconds. Turn out the white light and continue with the developing process, using only the ruby light.

DEVELOPING. One of the simplest developing solutions is prepared by using "Nepera," or any other developer in which the various chemicals are ready-mixed. This developer is available in eight or sixteen-ounce bottles and is inexpensive.

Mix up about one-half pint of solution, using one part of nepera by volume with four parts of water. Place this solution in one of the small enameled trays. This quantity will be sufficient for developing sixteen to twenty slides, but should not be saved from day to day. After the lantern slide plate has been exposed, remove it from the printing frame and slide it into the tray of developer, emulsion side up. The plate should be left in the developer from one to two minutes, and only experience will make it possible for the worker to determine just when it should be removed. It should be left in the solution until the picture shows clearly on the back of the plate. Usually further development will produce a fog.

FIXING. After developing, the slide should be rinsed in plain water and then placed in the acid fixer. It should be left in the fixer for twenty minutes.

The fixing compound or "hypo" is available in one-pound packages. The contents of a package should be dissolved in two quarts of water, following the directions which are printed on the outside. The "hypo" may be used several times and this quantity will fix about a hundred slides. The solution should be kept in a brown bottle or jar, which may be covered tightly, and should be stored in a dark place.

WASHING AND DRYING. After about twenty minutes in the fixer, the slides should be placed in a tank and washed in running water for ten to fifteen minutes and then placed in a rack to dry. When more advanced work is attempted, it will be necessary to control the temperature of the solutions and water rather carefully but

for this elementary work the usual temperature of tap water will be satisfactory.

MOUNTING SLIDES. When the slide plate is thoroughly dry, it should be projected in a lantern for examination. If it is clear and satisfactory, it is ready to be mounted for permanent use. A mat, which is a piece of black paper 3¼x4 inches in size with the center cut out in any desired shape and size, is placed next to the emulsion side of the slide. The opening in the mat is usually 2¼ or 2½x3 inches in size. After placing the mat in position, a piece of cover glass, 3¼x4 inches in size, is placed over it to protect the emulsion from damage. The slide plate, the mat, and the cover glass are then bound together with a strip of binding tape.

If the mat has on it a small white or gilded spot or star, this spot should be placed at the lower left hand corner of the plate. If there is no such mark on the mat, a small spot or square of gummed paper should be stuck on the outside of the cover glass in the same position. This spot will serve as a "thumb mark" to the operator when the slide is being projected in the lantern.

COLORING SLIDES. Lantern slides may be tinted slightly by soaking the plate in water which has been colored with pieces of Japanese water color stamps. If further tinting is desired, transparent water colors or Japanese water colors will be satisfactory. The proper coloring of lantern slides requires both patience and skill, but successful results will more than compensate for the time and energy involved.

After the pupils have made slides successfully, using the above process, they may take up the reducing and enlarging of negatives to the proper size for use in making lantern slides. This will require more equipment. The reduction and intensifying of slides may be learned. It is better, however, to try to make the negatives so well that these processes will not be necessary.

Pupils should be encouraged to make photographs of subjects which may be used in science, geography, history, agriculture, and other classes. Many subjects, such as wild flowers, birds, trees, plants and animals may be photographed in summer and the pictures transferred to slides for classroom use in winter. The production of lantern slides is an excellent activity for a science club or a camera club. As soon as one or two pupils learn the process well, they will be glad to assist other small groups of pupils and to make special slides for classroom use. Perhaps the club may be

given an opportunity to arrange the program for an assembly, at which time the slides will be used.

"POSITIVE" LANTERN SLIDES. Those who may desire to use lantern slides of the same quality as photographic slides but who may find it necessary to keep the cost of production as low as possible and to reduce the weight of the materials to a minimum, will find that lantern slides made of positive film prints will serve these purposes well. The process is simple. It is only necessary to transfer the picture negative of slide size to a positive film of the same size and place positive print between cover glasses. Two or three pairs of hinged cover glasses will be sufficient to use in projecting a long series of the positive prints, so a package of fifty to a hundred prints and the hinged cover glasses could be placed in the space ordinarily occupied by eight or ten slides. The process of making this type of print is quite similar to that of making photographic slide plates, except that positive film would be used rather than the sensitized glass plates.

ADVANTAGES OF GLASS SLIDES. As the reader may have gathered from the foregoing statements, the glass slide offers the most complete array of opportunities for the use of projected still pictures. A further advantage of the glass slide is that a carefully constructed slide either of the home-made or of the commercial variety offers the maximum of brilliance in the projected image. Another great advantage of the projected slide is that the image remains absolutely steady, and it may be left on the screen for any desired length of time. In those cases where the slide is being used for testing purposes, it is possible to time accurately the period of projection. In this way it is possible to adapt the slide to research projects in which it is desirable to consider the time element.

The greatest advantage of the glass slide over the majority of the other projected visual aids is that it may be used quite successfully in a room which has not been darkened thoroughly. There has been much said about daylight projection, and approximately 90% of what has been said should be discounted as being enthusiastic misrepresentation. There is no projected picture which will compete successfully with the interference of sunlight or very direct daylight. There are all sorts of schemes which may be used to secure a reasonably clear picture under adverse conditions where the light may not be subdued, but it is usually desirable to darken the room to a reasonable extent. This is not necessary, of course, with the outline slides such as the outline maps of states, countries,

or continents, nor is it necessary when using slides made from diagrams, typed on cellophane, or other home-made slides with distinct outlines. However, if slides containing great varieties of shadings or colorings are used, it is not desirable to project them in a well-lighted room. The results are not the best, and in most cases it is but a small task to shut out interfering light. In those cases where it is practically impossible to shut out light interference, the glass slide will be found to be the most successful competitor with that light, and may be used under conditions which would practically eliminate the other forms of projected pictures.

Those who are considering visual instruction materials should give some attention to the availability of the type selected. An unusual type of visual aid, even though it may be very satisfactory, may prove to be an unwise investment due to its unavailability in various sections of the country. The glass slide is almost universal in its availability, and the majority of the service bureaus which have visual aids available for loan have very complete assortments of well organized glass slide sets.

Another convenience of the glass slide is that it may be made from almost any type of drawing or photographic negative. Simple camera negatives can be transferred to photographic glass slides with ease. The process may be learned in a short time, and the enterprising teacher will be able to prepare, during vacation periods, much excellent material to be used through the academic year. The preparation of such materials should be of special interest to geography, nature study, and agriculture teachers who find many situations during the summer providing desirable teaching material to be used in winter classes.

PURPOSES SLIDES SERVE. There are several purposes which the glass slide may serve in the usual teaching situation. They may be used early in the consideration of any topic to stimulate interest or to introduce the new subject matter. They may be used early to develop a background for the material to follow either in discussion or in the presentation of other types of visual aids including the motion picture. They may be used during the study or discussion periods to clinch essential facts, to present vocabulary in the teaching of reading, or to help timid children recall facts they wish to emphasize in connection with class work. They may be used at the close of the discussion of any topic as a very effective review of the things which have gone before. The time and place for using the projected slides will need to be determined by the teacher in

each situation. A little experience with the use of these materials and it will not be difficult to know just when each will prove to be the most effective.

One of the greatest purposes served by the glass slide is that of giving training in expression and self-reliance. Home-made slides are very easily constructed either by the teacher or by the

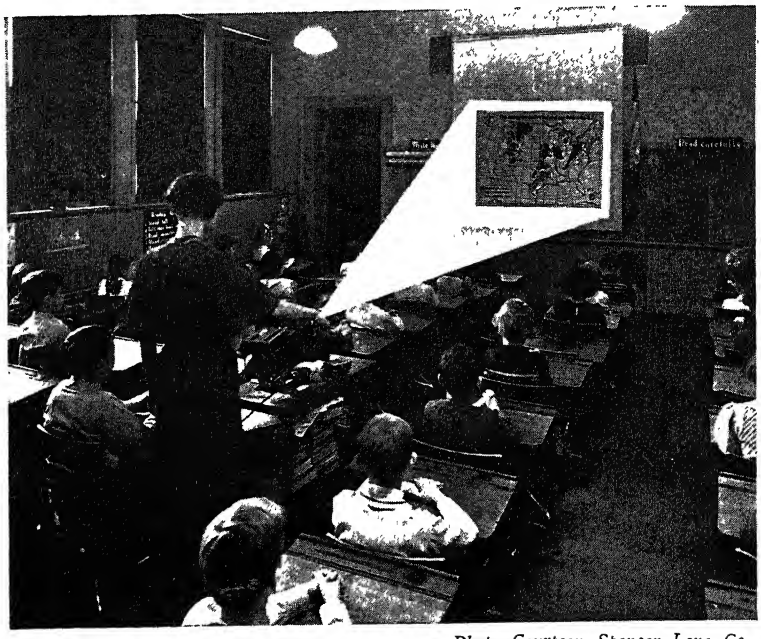


Photo Courtesy Spencer Lens Co.

Routine Use of Slides

pupils. In most cases, they will serve more effectively if constructed by the pupil for the purpose of illustrating his or her report to a class. A pupil in the school who has constructed an outline slide of the Panama Canal Zone and who has been assigned the task of explaining the location and importance of the Zone to his geography class will handle the work with much more personal interest and zest than if he is obliged to lead the same discussion without the aid of the projected material. These talks on individual slides by pupils in classes may be utilized effectively in many different subjects regardless of whether or not the pupils may have prepared

the slides. Anything of this sort which will tend to develop self-reliance and expression on the part of the pupils will be of great value in the training of those who participate.

Glass slides are being used in some of the larger cities to accompany radio lessons. In this way it is possible for an art supervisor, for example, to give a discussion of three or four noted paintings over a central radio station which discussion will be received in thirty to fifty school buildings where the slides mentioned in the discussion are projected before classes. It would be impossible for the same person to reach those groups by traveling from school to school, but by broadcasting the discussion it may be almost as effective, and certainly a very efficient way to handle an otherwise crowded schedule.

In certain courses it is possible to project typed slides on the blackboard or on a screen in the front of the classroom for the purpose of comparing the work of students or to make corrections. In all these uses of slides or other projected pictures, the chief advantage is that the attention of the entire group is concentrated upon the main topic of discussion. A single projected picture in the front of a darkened room attracts the attention of even the most docile in that room, and if properly presented will hold the attention through the discussion period.

LIMITATIONS OF GLASS SLIDES. Although glass slides are the most efficient of the projected visual aids from the standpoint of illumination and clearness, there are certain limitations which should be mentioned in any fair consideration of them. In the first place, they are rather heavy to transport from one place to another or to store in quantity. Shipping costs are higher than the cost of shipping almost any other type of visual aid. Another limitation is that they must be handled with care in order to avoid breakage. Although there are some slides constructed so as to be practically non-breakable, the majority of the slides of that type leave the emulsion side of the glass unprotected except for a thin coating of shellac, and there is danger of damage from scratching.

Glass slides require more space for filing or storage than some of the other materials for still projection. They cost considerably more than filmslides, but if handled properly will give almost unlimited service.

SUGGESTED USES OF THE LANTERN SLIDE. McClusky,* in his

*McClusky, F. D., et al, "The Place of Visual Instruction in the Modern School," Syllabus of a proposed text.

outline of a proposed text in visual instruction, suggests the following as a guide to those who desire to make the most effective use of glass slides:

1. The lantern slide lends itself admirably to socialized activity. Because of its "group appeal," it makes group consideration of a subject practicable in large classes. Many unprojected pictures are too small to be seen distinctly by all. The lantern slide may be seen by every child in the group while discussion is taking place.

2. The lantern slide focusses the attention of a group of pupils.

3. The lantern slide stimulates reflective thinking. It is possible for the teacher to control the length of time the picture is exposed so that the class may concentrate on each feature as long as is necessary.

4. The slide is flexible. It lends itself readily to being correlated with the subject matter under immediate consideration because any portion of a series of slides can be shown when needed without running through any other portions. It is also possible to refer to the same slide several times during the course of the lesson, because of the ready accessibility of each slide.

5. The slide provides an admirable means of reviewing a topic. It "tests the ability of the pupil to discuss a topic in a clear, vivid way." Slides may be referred to again and again.

6. The ink, pencil, ceramic silhouette, opaque, and cellophane lantern slide may be made by teachers or pupils. It is thus possible to "show only what is required without any distracting features." The cheapness of "home-made" slides makes them readily available to all teachers having access to a projection lantern.

8. The smallest number of slides required to develop, or interpret, the concept is the number of slides to be used. If one will do it, that is the number to be used. If more than one is required, the thought unit must be kept down to such a size that confusion of ideas will not result. It should be remembered that these experiences are to be remembered the same as new words in spelling, new combinations in arithmetic, etc., so that they can be recalled later and the imagery used in later thinking.

9. By projecting the picture on the blackboard, all sorts of markings may be made on the picture and erased without affecting the picture. This holds true not only for writing or printing words on the part of the picture which they symbolize in reading; but also such markings as are needed to explain operations, motions, special points of interest, etc., in the upper classes of junior and

senior high school and college. By this means the need for the motion picture may be reduced.

Teaching the Child How to Look at the Slide

1. The child, to understand and interpret the pictures so that he can use the knowledge thus acquired, must be taught how to look at the slide so he will not talk about the first thing he sees. When the child has clearly defined his aims or problems, he is ready to select from the picture that which answers or explains the subject under consideration. He will recognize other things, perhaps irrevelant, about which he would like to know more. These become subjects for further individual or class investigation. There should be some use of the stereograph in connection with the slide in the very early grades to teach the children the significance of lights, shadows, and of flat pictures. The pupils should be taught to expect a slide or stereograph to be used repeatedly, each time studying only the part of the picture that has significance for the problem at hand.

2. There are several technical points about a picture which it is well to train the child to recognize readily.

a. The slide which is to carry an unfamiliar message is of greatest value when there is something in it which is known. A person, automobile, or house is essential in some types of pictures if an idea of height, size, or distance is to be grasped.

b. Help the child to gain the habit of always looking for something of which he knows the size and then using that to help interpret the picture. The viewpoint of scope of the picture should be established, whether it is a near view including a few persons or objects, or a distant view covering a large area. In the case of mountains, the altitude at which the picture was taken is important in order to comprehend the heights of ranges and peaks. For placing the picture in correct location, time, or situation the child gains the ability to recognize a few simple fundamental geographic, historic, scientific, and human principles. In using a known object as a basis for judging sizes of unknown objects, it should be noted that the unknown object must be the same distance from the camera as the known. Unknown objects in the distance should not be compared with a known object close to the camera. This is obviated in the stereograph, which is three dimensional.

3. The training of the child's imagination and emotions, as well as the intellect and will, is essential so that he will unconsci-

ously feel and respond to that which is wonderful, lovely, true. and pure in pictures, whether in school or out of school.

4. Knowing how to look at pictures is not gained in a short time. It is the gradual recognition by the child of a group of principles and the ability to apply them. A very great amount of care should be taken by the teacher not to analyze a picture to such an extent that the message, beauty, wonder, and reverence are destroyed. The teacher's part in helping the child interpret a slide is that of guide.

THE SLIDE LESSON. The aims of individual lessons or a series of lessons determines the use of the slide.

1. In development lessons, the slides which show causes from which results can be deduced, or those which show results in such a way that causes can be investigated or the results be seen as further caused, are valuable. This means a psychological arrangement of the slides.

2. In a travel lesson, the need of a logical sequence of pictures is obvious either following the route or the central theme or purpose of the journey.

3. In an appreciation lesson of literature or art, slides are very valuable in creating an atmosphere, interpreting the life of other days, including the fairy realm, and in learning to enjoy the beautiful.

4. In some cases, drill lessons are not needed as much when using slides, because the desired information is kept before the child and thus in constant use.

5. Slides give a new view to a concluding or review lesson.

6. A great deal of value and power is gained through interpreting the slide in the socialized recitation.

7. Perhaps one of the greatest uses of slides is as a means of creating a situation and an atmosphere from which individual or class problems or projects can grow and develop.

As suggested above, there is no set time for introducing the slide in the process of teaching a unit of instruction. The slide, depending somewhat upon its type, may be used to introduce a subject; as a part of the study or discussion period; or as a review at the close of a unit of instruction. In each case, thorough discussion and questioning should be provided and permitted.

One of the chief features to be emphasized in connection with the use of slides, or of the majority of the other visual aids, is that

the materials and equipment should be readily accessible. If it is necessary for the teacher to go to another school building, or to spend an unusual amount of time locating the projection equipment, and still more time locating the materials, it is quite probable he or she will become discouraged and will fail to make proper use of the materials desired. The ideal situation would be one in which each teacher could have in her room or department a projector and an assortment of slides, including the majority of the slides to be used in connection with her classes. In such a situation the teacher would be able to do her work more effectively with a decided economy in time. Certainly there should be at least one projector in each grade, junior high, or senior high school building. If it is not possible to assign a projector to each department which will make use of it, the projector should be kept at the principal's office and should be ready for use at all times. It may be desirable to centralize the slide library in the school museum or school library, keeping the projector with the slides, but with the assurance that someone is responsible for its proper care and adjustment.

There are many excellent slides available for sale and for loan to those who may desire to use them. Some of these slides are such that no substitute could be provided. On the other hand, very effective teaching with slides can be accomplished with home-made materials. Pupils may make their own slides or the teachers may make slides to illustrate certain points. The pupil-made slides are particularly effective inasmuch as they call for the exercise of the creative ability of the pupil and provide the effective phase of education—an opportunity for participation and self expression. Every classroom in which the regular use of slide materials is attempted should be equipped with a home-made slide outfit.* An outfit for making home-made lantern slides which would be sufficient to provide 150 to 200 slides costs but $14.50 including a very convenient wooden case for the storage of materials. It is exceptionally useful. The outfit contains cellophane sheets, carbon paper, etched glass slides, cover glasses, colored pencils, colored inks, and a sufficient quantity of binding tape to make 100 slides. As certain materials may become exhausted, replacements may be made at reasonable prices.

Sometimes it is desirable to have pupils make slides on a competitive basis and to let the members of the class select the best of any subject or series. This tends to develop a perfection in slide

*Keystone View Company, Meadville, Pennsylvania.

making which will be of value to the teacher by providing excellent materials for future use. This experience will be of greatest value to the students themselves as a knowledge of slides and slide making will be extremely valuable in later courses.

STANDARDS SLIDES SHOULD MEET. There are certain standards which should be applied to the selection of all types of projection materials, particularly those which are to be used as a part of a teaching plan. First of all, there is no good excuse for presenting visual material which is incorrect or untrue in any respect. The impressions made by projected slides are so vivid and lasting that it is almost criminal to use a slide which is not absolutely true in its portrayal of any situation. This statement refers not to unreliability on the part of the person making the slides, but to the many situations in which a slide does not convey the correct impression. If the slide is supposed to be a typical illustration of life in any section, it should be a typical illustration rather than something

Photo Courtesy Keystone View Co.

A Slide Making Outfit

out of the ordinary. A picture of a farm home in Kansas should be of a farm home of average type, rather than a picture of an extremely fine or exceedingly poor one. A slide which includes pictures of different objects of various sizes should show those objects in their proper relation as to size. The same should be true of color. In short, the slide should be absolutely accurate in portraying that which is to be projected on the screen.

A second standard which should be observed is that of quality. The photographic quality of the slide itself should be of the very best. If the slide is tinted, the coloring should be expert and pleasing to the eye rather than splotchy or irregular.

The attractiveness of the slide itself will have much to do with its teaching value. If it contains too much material, or not enough, or is poorly arranged, or is not clear in certain parts of the picture, the pupils will lose interest in it.

There should be a concentration of attention on the essential elements to be noted or illustrated with the slide. If a slide of a certain important building is to be shown, that building should occupy the center of the picture and the surrounding elements should be in the background. If an object in nature is to be presented in slide form, that object should be the central attraction of the slide itself, and the other objects which surround it should become secondary.

The mechanical make-up of the slide is very important. The mask which "frames" the picture should be placed accurately giving the picture a smoothness and regularity which would not be the case if the mask is placed at an angle or is irregular in its border lines. In making slides it is much more satisfactory to purchase at small cost a set of masks which have been prepared with mechanical precision. This will give a uniformity to the slides which will be pleasing to the eye and will avoid distraction of the attention. The slides in any one set or group should be of exactly the same picture size, if it is possible to arrange them in that way. The showing of one slide which is very wide and narrow followed by another slide which is much taller than it is wide gives an undesirable effect and should be avoided wherever possible.

PREPARING COLLECTIONS OF GLASS SLIDES. Those who are interested in making the most effective use of slides will find it advisable to accumulate gradually a collection of materials which will be particularly suitable for the courses in which they are to be used. One of the first elements to consider in arranging such a col-

lection is the cost of the materials. Ordinary black and white photographic slides range in price from 35c to 75c each and tinted slides will range in price from 65c to $2.00 each depending largely upon the care required and exercised in the coloring. The cost of the materials themselves will make it advisable for the teacher to be very careful in the selection of materials to be added to a permanent collection. Of course many of the slides in the collection will be teacher- or pupil-made and this form of slide is not expensive.

Perhaps the next consideration will be care in determining just which slides should be colored and which should be black and white. A simple rule to be applied in making this decision is to ask whether or not color will add materially to the value of the slide. If not, certainly there is no justification for the extra expense incurred in preparing or securing a tinted slide. There are many situations in which the color will add considerably in giving a true impression of the object to be projected on the screen. In those cases, color should be used if possible. Some teachers who have become experienced with the tinting of slides have found it advisable to order uncolored positive prints and apply the appropriate tinting. The process is not difficult to one who is at all artistically inclined, but is one which requires a high degree of patience and care.

One of the paramount considerations in arranging a collection of slides, whether for individual or school use, is that of suitable filing or housing of the materials. In all cases, slides or other visual aids should be so filed as to be accessible with the least amount of effort. The indexing system used, regardless of whether it may be alphabetical by subject, or numerical, should be clear to all who make use of that set of materials. There should be complete lists of all slides available, and a copy of this list should be accessible to each teacher using the slides.

There are many convenient systems for filing slides so they will be readily accessible to the user. One of the most convenient forms is a large cabinet containing upright racks in which the slides are stood on edge and may be lifted in and out of the racks with ease. Furthermore, the slides are so arranged that the teacher may look through them without removing them from the case. These outfits are reasonably expensive but are worth the cost in those situations where they can be afforded. The usual plan

of filing slides is to prepare small boxes or drawers approximately the dimensions of the slide in which the slides stand side by side. Filing outfits of this sort may be purchased or may be constructed in the carpenter shop or by the manual training class.

The proper care and repair of slides is essential to keeping the service in working order. Slides should be handled by holding to the edges, rather than by grasping the face of the slide with the hand. Each thumb or finger print on the surface of the slide itself will tend to reduce the brilliance of the slide and will be projected to the screen as evidence of carelessness. The surfaces of the slides should be washed whenever they become dirty through use, and the binding tape around the edges of the slides should be replaced whenever the corners become broken or frayed. The binding tape protects the inside of the slide from dust and moisture, so it should be in good condition at all times.

Photo Courtesy Society for Visual Education, Inc.

A Method of Filing 2″ x 2″ Slides

In some instances the cover glass will be broken in handling the slides. It is a very simple process to remove the broken glass and replace it with a new one. However, if the glass on which the picture is printed becomes broken, it is very difficult to repair it in such a way that the crack will not show on the screen.

It is necessary in arranging for the distribution of slides among the various rooms or buildings in the school system to arrange some method which will be convenient and reliable. Usually the ordinary slide shipping cases are the best to use inasmuch as they may be subjected to rather rough handling without damaging the slides themselves. If a very cheap form of carrying case is desired, it may be made from heavy corrugated paper or of pressed-fiber board. These cheaper cases will require more careful handling but, unless the materials are to be sent long distances, there should be very little danger from damage or breakage.

PREPARED ASSORTMENTS. Keystone* has prepared special collections or assortments of slides for use in various levels and subjects of instruction. One set is prepared especially for primary work and other sets are designed more particularly for the intermediate and upper grades. These sets contain some 150 to 600 slides and duplicate stereographs thoroughly cross-indexed with an accompanying teachers' manual which is full of helpful suggestions.

In addition to these very large and complete assortments, the Keystone Company provides selected groups of slides for special subjects in the fields of general science and geography. These are arranged in small sets of 15 to 20 slides each, keeping the sets within the recommended size for ordinary school use. Other special sets of this nature are available from the various sources mentioned on page 202.

PROJECTION EQUIPMENT. A few years ago it was rather difficult to select suitable projection equipment for the use of glass slides. There were many projectors available which were offered at a wide range of prices. Each was supposed to be the best in its field, and the person interested in purchasing was left somewhat in a quandary by the various representations. At the present time, however, there are but three of four leading makes of projectors and any one of these instruments will give very good results in the average situation. There have been many improvements adapting the classroom lanterns to various situations. These improvements have included stronger illumination, lens equipment of higher quality, adjustable bases for the use of the lantern on irregular surface, and readily accessible optical parts. It was formerly necessary to almost dismantle a lantern to change a lamp or clean the reflector and lenses. The modern lanterns are arranged with hinged lamp houses, so the entire optical system is open to inspection or for necessary care and adjustment by simply tilting the lamp house forward or backward. It was also necessary to exercise great care in replacing the lamp to be certain that the lamp was in perfect alignment with the optical system. The new projectors use pre-focussed lamps, which may be changed by anyone, usually without making any adjustments whatsoever.

The average glass slide lantern, complete with carrying case, will cost approximately $70.00. This includes the lamp which is in the projector, but it is usually advisable to secure an extra lamp

*Keystone View Company, Meadville, Pennsylvania.

at the time of purchase to be protected from embarrassment or delay when the original lamp burns out. These lamps will give 100 hours or more of projection service on the proper type of current, but an unusual jar or careless handling of the projector may cause a lamp to break or burn out at any time.

OPTICAL PARTS OF THE PROJECTOR. The optical parts of a glass slide projector are essentially the same as those of all projectors, still or motion. At the back of the projector there is a reflector to reflect forward many of the rays from the lamp which would be lost without it. Just ahead of the reflector is the lamp, which is

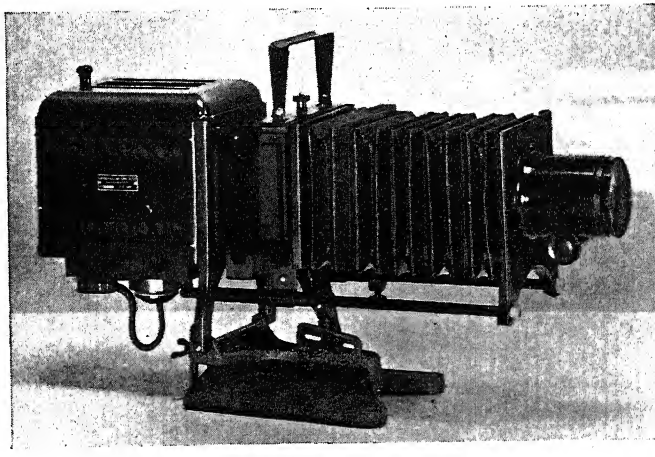


Photo Courtesy Bausch & Lomb

A Standard Glass Slide Projector

the source of illumination for projection. The next unit is the condenser, which is usually composed of two or three lenses in a series. Its purpose is to concentrate the direct and reflected rays of the lamp on the slide or other object to be projected. The slide itself occupies a position in the slide rack or aperture of the projector which is just in front of the condenser lenses. The foremost part of the projector is the objective lens which is used to secure a clear image of the projected picture on the screen at any given distance. This must be moved forward and backward somewhat in accordance with the distance of the projector from the screen, and is mounted on a sliding rack to permit easy adjustment. On the majority of

the projectors the space between the objective lens and aperture gate or slide rack is covered by black fabric or leather bellows. This bellows serves several purposes. It avoids the possibility of stray light hitting upon the screen, walls, or other parts of the room, and serves to prevent interference with the light rays themselves. Furthermore, it serves as a protector for the lens and aperture gate, by keeping out dust and other particles.

CARE AND OPERATION OF THE PROJECTOR. One of the greatest advantages of the glass slide projector is that it may be operated by almost anyone. There are certain simple rules which must be observed in handling the instrument, and the best results will not be obtained if those are not observed. In the first place, all parts of the projection equipment should be kept as clean as possible. Dust should be removed from the metal parts and from the leather bellows by using an ordinary dusting cloth, and should be removed from the lenses by using a lens cleaning tissue or a lintless linen. A very satisfactory type of lens cleaner for these larger lenses is the soft tissue which is used for various purposes in the home. It is not desirable to wash the lenses unless they become rather thoroughly coated with dust and oil of some kind, and in that case a soft cloth moistened with benzine will clean the surface quickly.

Although the best projectors can be adapted to almost any situation and will operate with reasonably satisfactory results even in a lighted room, it is usually advisable to arrange a projection table or some other convenient support for the projector and to darken the room. Any manual training department can make a projection stand at very little cost, and can build into it a small drawer to be used for a dusting cloth, lens cleaning tissues, an extra lamp, extension cord, and such other items as will be necessary in operating the projector regularly. If light is needed in order that students in a classroom can take notes while slides are being shown and discussed, it will be better to pull all the shades, shutting out the interfering daylight, and turn on the incandescent lamps in the room. The incandescent lamps of usual strength will not interfere with the projected picture nearly as much as light from one or two open windows on a clear day. The most satisfactory plan for providing a working light in the classroom is to suspend reflector lamps below the eye level of pupils. One such lamp will provide adequate light for two to four pupils and several in the room will not interfere with projection.

ADJUSTMENT OF THE PROJECTOR. The principal adjustment needed in operating the glass slide projector is that which will adapt it to the projection distance in a given situation. This can be accomplished quite easily and should give no one difficulty. Other adjustments may be necessary at times to accommodate a sloping desk on which the projector is placed, or to take care of the elevation of the picture to the screen. This can be accomplished usually by loosening the small set-screw at the base of the projector, adjusting the projector, and tightening the screw again.

Sometimes it is necessary to adjust the lamp itself. The majority of the projectors have made provision for this. The lamp socket is mounted in a sliding support which is held in place by a small set-screw at the bottom of the lamp house. After the set-screw has been loosened, the entire lamp assembly may be moved forward or backward in the lamp house as necessary. It should be adjusted to the point where the clearest image appears on the screen. Sometimes it is advisable to adjust the light against a small, white card as the variations can be noted more quickly than on the screen. Usually the lamps are set at the proper place when the projector leaves the factory and it is not advisable to make any change. In the case of the older projectors, which have been adjusted frequently, it may be necessary to move the lamp to the proper position.

SELECTION OF A PROJECTOR.* The selection of a glass slide projector for any situation can be determined only by giving consideration to the situation. Projectors which would be entirely satisfactory in one room or building might not prove to be desirable in another. This does not mean that one make of projector has any great superiority over any of the others, but that the equipment itself should be selected with some degree of care. For example, if the rooms in a building for which the projector is to be purchased are extremely long and narrow, it is quite probable that a projector will be needed which has a lens of comparatively long focal length. If the room is short, a shorter lens will be needed in order to get a large enough picture to be clear to all in the room. In ordering a projector, therefore, it is necessary that the distance from the place where the projector is to be located in the back of the room, to the screen in the front of the room be given, as well as the approximate size of the picture desired on the screen. It is then possible for the manufacturer or distributor to select the proper length of lens for that situation. The majority of the standard classroom

*See list of manufacturers and distributors of glass slide projectors, page 203.

projectors for glass slides have become somewhat standardized in the use of 150- or 120 volt, 500-watt lamp, so it is hardly necessary to give any consideration to the illuminant.

If it should be that a lantern is desired for use in an extremely large auditorium, it will be necessary to secure one which has a lamp stronger than a 500-watt lamp, as well as an objective lens of

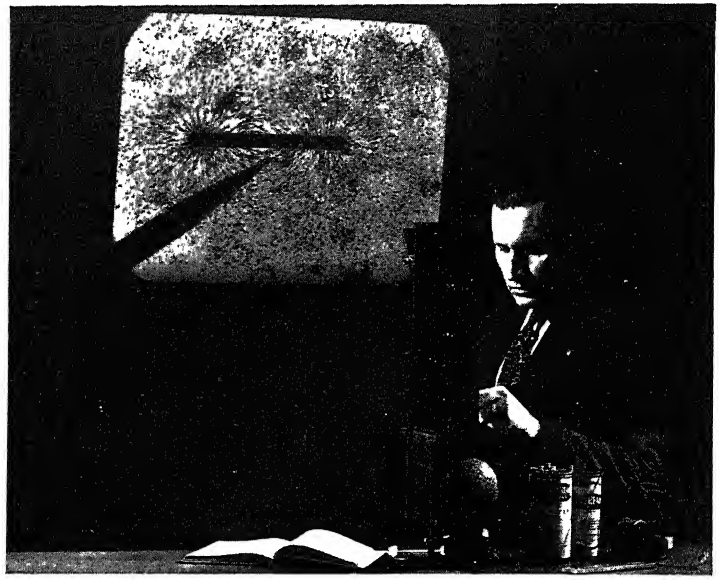


Photo Courtesy Spencer Lens Co.

A Lecture Table or "Overhead" Projector

extremely long focus. This increase of the illumination naturally increases the amount of the heat generated by the lamp and makes it necessary to use some sort of a protector for the slides. In some cases a motor-driven fan propels a current of fresh air past the slide during projection to prevent it from excessive heat. In other cases a water cell is inserted between the condenser lens assembly and the slide for the same purpose.

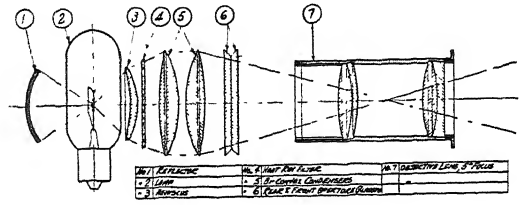
Those who may be interested in securing a lecture lantern for personal use and may want to secure the most convenient equipment will find the overhead lantern to be highly satisfactory. With this lantern it is possible for the teacher to operate it at the front of

the room, thus facing the class and facing the slide although the image itself is projected over the head of the instructor against a screen at the front of the room. This outfit is not recommended ordinarily in those situations where portability is desired, for it is rather difficult to move the screen from place to place and suspend it at the proper angle for clearest projection. Many instructors in colleges and universities have found this lecture-table type of lantern to be especially satisfactory as it can be adapted to so many useful purposes. In some instances it can be used in large auditoriums for lecture demonstrations, thus avoiding the necessity of arranging a system of signals between the lecturer and the operator.

COMBINATION EQUIPMENT. There are numerous combinations of projection equipment, some of which may prove to be desirable under the proper circumstances. For example, a standard glass slide projector may be purchased at $70.00; a filmslide attachment may be added to this projector at a further cost of $38.50; a Stillfilm attachment may be inserted in place of the slide rack on the projector at a cost of $9.50; or a micro-slide attachment can be added to the objective lens of the projector at a cost of $20.00. Thus it is possible to equip one projector for the use of glass slides, filmslides, Stillfilms, and micro-slides. In most cases, however, it is not advisable to attach so many different things to the one projection unit. The use of the equipment is limited to one room at any one recitation period. If separate instruments were available, it would be possible to use two or more different types of visual aids simultaneously in different parts of the building. Furthermore, the cost of a separate filmslide projector is approximately the same as the cost of a filmslide attachment for the glass slide projector.

A similar combination of equipment can be arranged by adding these various attachments to a standard opaque projector. The opaque projector costs $75.00 and a glass slide attachment costs $35.00 more. A filmslide attachment can be added for $38.50 and the other attachments as mentioned above at the prices quoted. The same objection is raised to this elaborate combination; it is less portable and is restricted to the use of one type of service at one time. It may be desirable to have one or two extra attachments for the glass slide lantern, and the extent to which the equipment is to be used in one room should be the determining factor. If several teachers in a school building are planning to use projected visual aids of various kinds, there should be as many different projection units as possible rather than a combination outfit.

PRINCIPLES OF PROJECTION. The above discussion has mentioned some of the principles which should be applied in the projection of pictures. There are certain factors which determine the size of the picture: the distance from the screen, and the focal length of the lens. There are other factors which determine the quality of projection: the strength of the illuminant, the quality of



Drawing Courtesy Society for Visual Education, Inc.

Typical Optical Arrangement in Filmslide Projector

the equipment itself, and the interference of light. Much has been said about daylight projection. It has been mentioned earlier in this discussion. Perhaps it is well to mention it again inasmuch as there are so many incorrect ideas concerning daylight projection. As a matter of fact, there is no such thing as a "daylight" projector. The projector of today is many times as efficient as those which were in common use fifteen to twenty years ago. It is true, also, that these more efficient instruments will give reasonably good results in situations where it would be impossible to secure even passably good pictures with the old types of projectors. This does not mean that daylight projection, or anything approaching it, is entirely satisfactory. It does mean that in cases where outline slides are to be used or slides which have extreme contrasts of black and white, they may be used in rooms which have been darkened only partially. It means that in those cases where the school architect failed to provide suitable shades for darkening the room, a limited amount of projected materials may be used with varying degrees of success. However, the teacher or administrator who is interested in purchasing equipment should not be fooled by the various representations of daylight projection either with glass slide projectors, motion pictures projectors, or any other type of instrument which is expected to provide a clear image.

The Filmslide

The filmslide, which has been in use for the past twenty years, is another type of projected still picture. It differs from glass slides by printing the pictures in series on 35-mm. film. The film pictures, therefore, are reduced to about ¾"x1", or 1" to 1½" in size, and their cost, weight, and storage space are reduced correspondingly. Although the slides are in fixed series, slight projector adjustment makes it possible to show the pictures in any order which may be desired. Also, the individual pictures may be mounted between 2"x2" cover glasses.

Photo Courtesy Society for Visual Education, Inc.

Section of a 35-mm Single Frame Filmstrip — Actual Size

The filmslide is called by various names which should be mentioned here to avoid confusion. "Filmstrip" is a name used in some places. Here and there the nomenclature is reversed, and we may hear "slidefilm," or "stripfilm." They are known to some as film rolls, and as stereopticon films. The trade name adopted for them by a leading producer is "Picturol," and "filmslide" is the name used by many of the educational producers; but these names all refer to the same convenient picture, as illustrated here. Filmslides were introduced by the Society for Visual Education, Inc., in 1920. Their use has spread extensively, not only among schools and churches, but also in the industrial field, among CCC camps, and in other Government agencies.

There are two common sizes of the filmslide; the single frame slide and the double frame slide. The single frame slide, as yet by far the most used, was described partially in the preceding paragraph. The width of the picture is across the film, the top of the picture on each frame or "slide" being toward the head of the film, so the filmslide runs through the projector vertically. The double frame

slide is about 1½"x1" in size, but is printed on the same width of film—35-mm.—so the width of the pictures runs *along* the film, the top and bottom of the ordinary scene being toward the edge of the film, as illustrated below. This means that the double frame filmslide ordinarily runs through the projector *horizontally*. An exception occurs whenever a vertical picture has been taken, as of a tree or high waterfall, by turning the camera vertically. This necessitates turning the aperture gate of the projector to a vertical position to present the image in proper position on the screen. This should not be done by the seemingly simple expedient of turning the projector on its side, as modern projection lamps are made to burn base down, and most of them will soon burn out if placed

Photo Courtesy Society for Visual Education, Inc.

Section of a 35-mm Double Frame Filmstrip—Actual Size

in any other position. Thus a more versatile projector, a swivel-head type, is required for double frame filmslides.

The rapid growth of the private use of miniature cameras with double frame exposure on 35-mm. negative is bringing the double frame filmslide into widespread use in presenting the visual phases of special projects. Also the very important work of the library associations in many parts of the world, in arranging for the making and exchange of miniature photographs (on filmslides) of the pages of rare books and manuscripts, promises to result in the production of enormous quantities of double frame filmslides.

An important variation of filmslide practice and production has already grown to useful proportions. We refer to the mounting and preservation of individual frames clipped from filmslides.

This is done either between stiff cardboard masks or between miniature glass slides 2″x2″ square. Certain filmslide projectors* are fitted with miniature slide carriers so these individual frames may be projected in any order desired. This practice grew out of the fact that amateur photographers in their educational projects frequently found only part of the pictures on any one roll of negative suitable for use. But it fits in exactly with the desire of many instructors not to be limited by the fixed sequence of views in a filmslide. The 2″x2″ slide is rapidly replacing the old style lantern slide.

Photo Courtesy Society for Visual Education, Inc.
Filmslide Projector with Miniature Slide Carrier

While this individual treatment of filmslides is more expensive than the filmstrip method, it is being developed extensively by some instructors who are creating and accumulating transposable lecture materials for their local school or college needs. It is also definitely provided for, in addition to the filmstrip method, in the Eastman Kodak Company's service to Kodachrome (color film) users.

Because most of the current miniature camera work done by individuals is in double frame size, many of the double frame projectors are equipped with slide carriers for the projection of individually mounted frames, although the frame itself may have been clipped from either a double or a single frame or Bantam filmstrip. By using different masks, either can be mounted between 2″x2″ glass plates. These miniature mountings are com-

*These are Argus Models A and B; Eastman; Leica; S.V.E. Models BB, CC, DD, and AA Tri-Purpose; and Models EK and AK for 2″x2″ slides only.

monly held together by binding the edge with ⅜″ Scotch tape, which sticks tightly without moistening, but which can be removed quite easily if desired, also without moistening. This is a very important point when using such small bits of film, one side of which is covered with emulsion which can be spoiled easily if permitted to become damp.

ADVANTAGES. The introduction of the filmslide placed at the disposal of many schools pictorial matter which had been too expensive or too limited in quantity to cover the needs of the average school. Glass slides were fine when they could be obtained; and in the opinion of some, they still remain unequalled for brilliant projection. But schools which have had access only to a limited supply of glass slides and could not afford to purchase in that form more than a small portion of the materials needed for frequent use, have found that the filmslide is a highly satisfactory substitute at considerably lower cost. In fact, when economy becomes essential, the filmstrip is the best answer, and is so improved as to rival standard glass slide quality.

Several of the advantages of the filmslide were presented by Mr. Bell in his discussion before the Fourth Annual Conference of School Administrators.* "There are a number of different types of visual aids and each of them has its place in teaching, but of course, there is a great deal of overlapping in their usefulness. The particular visual aid that I am to discuss is the filmslide, or as it is usually called, the 'Picturol.' The filmslide is in reality a strip of 35 mm. motion picture safety film with a series of different pictures printed on it. It has most of the advantages of any still picture. The projection machine is noiseless in operation and does not distract the pupil's attention from the picture; the projection machine is about the simplest of all types of machines to operate; the pictures cannot be gotten out of their correct order and there is no danger of breakage if they should be dropped. The filmslide requires small storage space and is easily shipped from one school to the next. It is one of the most economical types of visual aids available; the showing of the filmslide, as with other types of projected pictures, has the capacity of centering the attention of the class; each picture can remain on the screen as long as needed.

*Bell, Walter S. From an address given before the Fourth Annual Conference of School Administrators, Austin, Texas, January, 1938. Reprinted in the *Visual Review*, 1938, pp. 13-15.

"Teachers, at times, make the mistake of using a motion picture when a still picture would be better. There is nothing that can replace the motion picture when you need to show motion, or when you need continuity of action; but why show a motion picture of such inanimate objects as Stone Mountain, the Grand Canyon, or the cliff dwellings of Mesa Verde? Do you not lose something of the feeling of the stability of such inanimate objects when you see them in motion pictures? Please do not misunderstand me, I am not criticizing the motion picture as a visual aid, I think the motion picture is possibly the most valuable teaching aid that we have, when it is used for the purpose for which it was made, that is, to show motion. On the other hand, the still picture is a valuable teaching aid when it is used as intended."

The filmslide is unusually economical to purchase. A complete roll of twenty-five to seventy-five pictures may be purchased at an average cost of two to five cents per picture, the roll weighs about one ounce, and is kept in a box or can so small that several will fit into the palm of one's hand. Also, the fact that the pictures are

35-mm Filmslide in Storage Can

Photo Courtesy Society for Visual Education, Inc.

arranged in a carefully edited sequence on the strip of film appeals to many teachers of standard subjects in the curriculum, as they do not always have the time or inclination to assemble individual slides from various sections of a cabinet and re-distribute them properly after use. The projection equipment for use with filmslides is inexpensive, simple to operate, and economical of weight and space.

There are many teachers who desire to prepare illustrative materials for projection in their classes. In most cases, these

teachers have but limited funds with which to cover the cost of such materials. The filmslide offers the least expensive photographic slide service. As explained later, small cameras are available to be used in taking pictures on 35-mm. negative. These cameras are simple to operate and are efficient. The pictures are just the right size to be used in the filmslide projector, and may be produced easily by the amateur at home, in school, or in the camera club. Thus, by the exercise of a little care and skill, excellent filmslides can be made by a teacher who has access to a 35-mm. miniature camera. The entire cost of materials, developing, printing, etc., may be kept below an average of five cents per picture, ready for projection.

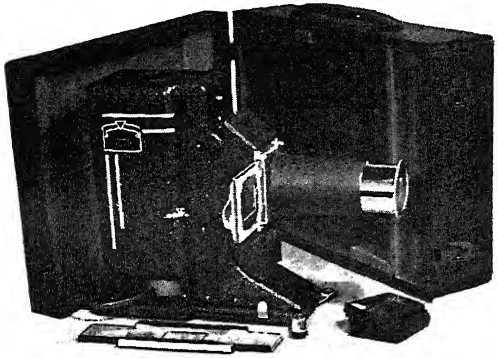
Many school administrators and supervisors, as well as instructors, have found such photographic apparatus to be very convenient for recording special teaching projects, situations where repairs and replacements are needed, photographs of pupils, and the like. At the appropriate time, these may be projected for group discussion and consideration. Teachers of vocational agriculture may photograph growing live stock and crops during the summer months when school is not in session, and use these pictures during the winter for class study. Some prepare photographs of drawings and charts for projection before classes.

Because of these and possibly other advantages, the increase in the use of filmslides in less than two decades has placed in the schools of the United States more pictures in this form than there are reported to be glass slides after more than a half century of usage. Certain it is that there is more new educational visual material available in filmslide form at present than in any other. It is interesting to note that in recent years the demand on the United States Department of Agriculture for stereopticon pictures is now solely for filmslides, whereas as late as 1932 thousands of glass slides were requisitioned annually for loan.

Other Government agencies are using filmstrips for training purposes and have found these convenient small pictures to be unusually satisfactory.

LIMITATIONS. The principal earlier limitation of filmslides was chiefly the limitation of projection. It was difficult to obtain sufficient brilliance of projection without danger of damage to the film. The development and use of efficient heat-ray filters has dissipated this danger, without reducing materially the projection

efficiency. The temperature at the aperture gate, which is important in the projection of all types of still pictures, has been reduced to the point where it is no longer a problem. This makes it possible to use 200- and 300-watt concentrated filament lamps for projection. With these, it is possible to secure projection results which are entirely satisfactory under all ordinary circumstances.



300-watt Miniature Slide Projector

Photo Courtesy Society for Visual Education, Inc.

A minor limitation, already touched upon, is that the filmstrips are in a fixed sequence normally. This may or may not be a limitation, depending upon the resourcefulness of the instructor who wishes to use them. In many projectors, the filmslide can be run backward or forward to select desired pictures in different order or for a different purpose than for which the filmslide was designed. While showing the pictures in a filmslide in irregular order is possible, it is not as convenient as selecting the desired slides from among those of a set or series. As mentioned earlier, for those who insist upon such selection, the miniature glass slide or the mounting of individual frames from filmslides between 2″x2″ glasses, provides the answer.

A few may feel that there are too many pictures in a filmslide for use during one school period. In fairness, however, it must be said that such a feeling seems to be a survival of the days when pictures meant entertainment. When pictures are used for instruction, the thoughtful instructor might very seldom use all, or even half of the pictures in a filmslide in one period; but often he will be glad that the filmslide carries an abundance of pictures from which he may choose.

PRODUCTION OF FILMSLIDES. As mentioned above, it is rather easy to produce filmslides. The cameras for the single frame size

of 35-mm. pictures have practically disappeared from the American market. Filmslides with single frame pictures, made from stock or for quantity distribution by the commercial producers, are photographed with adaptations of the more expensive motion picture camera, or with especially built and laboratory mounted automatic focus cameras costing hundreds of dollars. This apparatus is designed for quantity production of high quality and the production service is available to schools at moderate cost. It is only necessary to provide the illustrations and appropriate instructions concerning the sequence desired.

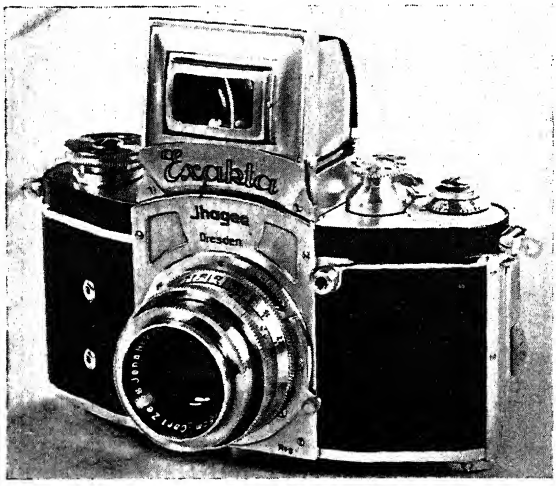


Photo Courtesy Bell & Howell.

Reflex Type 35-mm Camera

The majority of the 35-mm. cameras now available for use by individual enthusiasts are for double frame pictures, the characteristics of which have been described above. There are several reliable makes.* These range in price from $10.00 upward and are used for almost every purpose for which any type of camera would be useful. Experts and advanced amateurs select high speed cameras, slow speed cameras, special lenses, filters, etc., all at prices lower than the cost of comparable equipment for the production of

*Argus, Contax, Eastman, Exakta, Leica, Welti, and Zeiss.

larger negatives. The cost of operation is very much in favor of the miniature camera. Pictures may be produced at two to five cents each, whereas the average cost of standard camera photographs is about thirteen cents a picture. Furthermore, these little cameras are unusually satisfactory and economical for the production of photographs in natural color. These may be projected, duplicated, or enlarged with highly satisfactory results.

Quoting again from Bell*—

"Many schools are finding that there is a real use for home-made filmslides, which can be made with the miniature camera.

"If a filmslide is made of the school journey, or excursion, it will be very valuable in helping the children *recall correctly* the things they saw and did. This will make the journey doubly beneficial. Every school, I think, would like to have a record of the school activities. The home-made filmslide is a practical answer to the problem of how this can be done.

"As the pictures of the school activities are shown from year to year, there will develop new ideas as to how the activities for a given year can be improved. The filmslide of school activities can be used effectively to interpret the school program to the school patron and general public.

"They can be used within the school system to show how the best teachers are solving their problems and in this way help the poorer teacher to do better work.

"At first, we would suggest that only outdoor pictures be made, then later, the school photographer will naturally want to try some indoor pictures.

"The inside pictures with the outside pictures will give you a complete record. Many senior high school teachers and college teachers seem to feel that the lecture method of teaching is the method best suited for their work. A dry lecture can be made into an interesting lesson oftentimes by the simple expediency of using a filmslide to illustrate what is being said."

These little 35-mm. cameras and film, producing negative exposures about 1½" wide by 1" high, are used for everything that can be done with almost any other type of photographic equipment. The pictures are recorded *along* the film, rather than across it as on the single frame filmslide. The high quality of many of the

*Bell, Walter S. From an address given before the Fourth Annual Conference of School Administrators, Austin, Texas, January, 1938. Reprinted in the *Visual Review*, 1938, pp. 50-51.

negatives produced permits making enlargements to any desired size. By using an auxiliary lens, copies of photographs, drawings, manuscripts, or other flat materials may be made. The uses of the miniature cameras are almost unlimited, especially for those who desire to collect materials to be projected in classes or before other groups. As previously indicated, the positive film prints from this negative are filmslides, and may be printed in sequence on filmstrips, or mounted between glass as individual slides

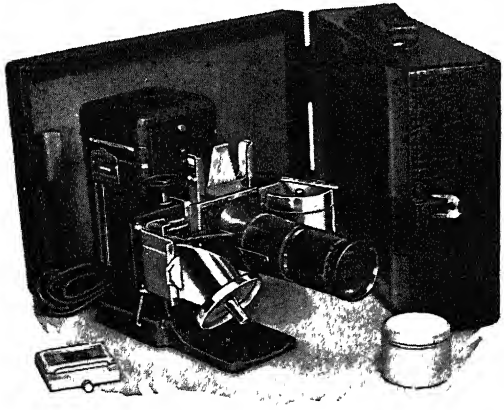
If it should be desirable to have enlargements of some of the pictures which appear on the small film, such enlargements are comparatively easy to make, as low priced equipment is available for the purpose. Some amateurs have attained great skill in making enlargements by projection of the negative image through inexpensive enlarging equipment. Or, one can have moderate sized enlargements made by reliable photo finishing laboratories at a cost of from six to twenty-five cents each. With the newer fine grain films, it is possible to secure results which permit enlargement of ten to fifteen times the dimensions of the negative.

The load, or roll of negative, used in the double frame 35-mm. cameras is long enough for 36 exposures, and is commonly priced at seventy to eighty-five cents. Those who may be economical in their inclinations should purchase raw film in 400 foot rolls and load their cameras at a cost of about thirty cents per roll of 36 exposures. The usual charge for developing the negative and printing one positive copy for projection is $1.00. This includes about thirty cents for developing, and about two cents per picture for printing. The appearance of semi-automatic selective printers in the market at popular prices will solve the printing problem for most amateur miniature camera and filmslide enthusiasts, especially if they have access to the facilities of a school laboratory or camera club dark room.

The most recent and delightful development in the production of filmslides is the natural color film for the miniature camera. Unfortunately for those who would like more than one positive copy, this is a "processed" film; the beautiful colored projection positive is made by "reversing" the negative itself. Where a number of similar or identical negatives can be made at the same time, of course the camera owner eventually has that many similar positives for use. The manufacturers of color film for use in miniature cameras now produce duplicate prints for projection or may make enlargements in full color. The service charges now seem high, but

there is every indication of much lower prices as these films are used more extensively. The price of the negative—$1.80 for an eighteen-exposure roll—includes the processing, so the cost per picture, ready for projection, is about ten cents. This is far cheaper than hand colored glass slides; cheaper, in fact, than the majority of black and white glass slides of standard size. (See lists of manufacturers, pp. 202-206.)

PROJECTION OF FILMSLIDES. Filmslides are usually shown in special projectors designed for the use of filmslides only. The filmslide projectors range in price from $15.00-$57.50, including carrying case. It is usually desirable to purchase the best equipment the budget will permit. With these it is possible to keep one picture on the screen for any reasonable length of time without damage to the filmslide.



150-watt Tri-Purpose Projector Equipped with Patented Heat Ray Filter

Photo Courtesy Society for Visual Education, Inc.

There are special attachments to the standard models of glass slide projectors, for the protection of filmslides. They are as expensive as the separate filmslide projectors, and are not as efficient in protecting the film from heat. It is recommended that the school secure separate projectors for filmslides, so the glass slide projector can be used at the same time—in a different room if desired—and so the more expensive 500-watt lamp of the glass slide projector will not be used unnecessarily.

The filmslide projectors generally in use in school are the ones which accommodate only the single frame slides. With the increase in local and individual use of miniature cameras, and the gradual

growth of stock libraries of double frame filmslides, it will be desirable in many places to secure projectors which accommodate both sizes. Some of these projectors, known as Tri-Purpose projectors, also accommodate the miniature glass slides made from individual frames by camera enthusiasts who have discarded the poorer frames from their filmstrips, or by instructors who are building a collection of selective lecture illustrations. Double frame filmslide projectors do not exceed the others in price, as a rule; and the combination tri-purpose models just described are available at $35.00 to $57.50, complete with carrying case. A list of manufacturers of filmslide equipment may be found on page 203.

SOURCES OF FILMSLIDES. There are many producers of both stock and special filmslides, and some maintain large libraries of this material on thousands of subjects. The two largest such libraries in the United States were combined in the summer of 1936. There is a combined catalog compiled and published by the Society for Visual Education, Inc., Chicago, which lists the filmslide subjects of all the larger producers of filmslides for the general school field as well as subjects for use by churches, Boy Scouts, etc. There are many sources from which filmslides may be secured on loan or may be purchased. Several of the University Extension Divisions have full libraries of filmslides for loan to schools. Some industrial organizations from time to time arrange for the production and distribution of valuable filmslide sets among schools at little or no cost.* The average strictly educational filmslides carried in stock by the producers and distributors range in price from $1.00 to $3.00, with the majority listed at $2.00.

The United States Department of Agriculture, through its Extension Service, offers a very economical filmslide service to those who may be interested in material for use in teaching agriculture in its many phases. The department has prepared many sets from its vast library of photographs, and these special sets are listed in mimeographed catalogs and are priced generally at fifty cents or more per roll. It is not claimed that this low price represents the full cost of these special and often very valuable agricultural filmslide productions, as the government absorbs the overhead, postage, and advertising costs. But it has enabled many schools offering vocational agricultural courses to purchase a considerable quantity of this material and establish filmslide libraries for permanent use,

*Free filmslide distribution to schools has usually been made through the Society for Visual Education, Inc., Chicago.

when they otherwise could not have done so. Other Government agencies have filmslides available and are glad to have them used among schools.

A list of sources of filmslides of various kinds will be found on page 203 of this book. The majority of the organizations listed have subjects available in various fields and will be pleased to send complete information upon request.

The Silent Motion Picture

HISTORY OF THE MOTION PICTURE. The thing we call a motion picture, which is not a picture of motion at all, has been in existence for countless ages. That is, the principle of the motion picture has been known to mankind for three or four thousands of years. Historical records indicate that in ancient China there were devices which produced the effect of motion perceptible to the eye. One of these devices has been explained as being a dark box in one end of which was a small peep hole and in the other end a hole about three inches square. Some enterprising Chinaman with artistic ability had painted similar pictures in sequence on a strip of silk approximately three inches in width, and this strip of silk was pulled past the large opening by one person while another placed one eye at the small hole to see these marvelous pictures of action. It was a far cry from those early attempts to produce the illusion of motion to the development of the motion picture film which is used so extensively for education and entertainment today. However, the ancient and the new depend upon the same psychological phenomenon for the illusion.

Psychologists tell us that an image on the retina of the eye remains there approximately 1/12 of a second after the object itself may disappear from view. This is known as "persistence of vision." If we can arrange, therefore, to remove one picture and substitute another similar picture within the period during which vision persists we can carry the person who is seeing the pictures from one to the other with a feeling of continuity just as we do in projecting the motion picture today. The pictures are changed on the screen at the rate of sixteen times per second when the silent films are used, and at the rate of twenty-four times per second when sound pictures are used. The result is a smooth continuity of the series of still pictures placed so closely together that the eye travels from one to the next without noticing the break or

change. The ordinary motion picture reel, therefore, is made up of a series of 16,000 separate and distinct still pictures which are closely related, and are projected on the screen within a period of eleven to fifteen minutes.

One of the first attempts at producing motion pictures was made by Leland Stanford late in the nineteenth century. He was interested in determining whether or not a certain horse actually raised all four feet from the ground at any time while it was traveling around the race track. Motion picture cameras had not been invented, so several still cameras were placed side by side around a sector of the race track and separate pictures were photographed as the horse passed these points. The experiment was successful in answering the question, but a young engineer by the name of Isaacs was given the task of devising an apparatus which would produce a continuous record of the action of the horse. To him is credited much of the early development of the process for recording motion pictures. It was not until in the last few years of the nineteenth century that pictures were produced which were even passably satisfactory for educational or recreational use. It is interesting to find that the motion picture apparatus invented by Edison was perfected for the purpose of recording and projecting pictures to be shown in conjunction with phonograph records—pictures of the recording artists.

The first moving pictures presented to the public were offered in doorway recreation spots such as the penny arcades of today, and created quite a stir among those who would drop the penny in the slot to see John L. Sullivan strike a few times at an opponent. As the popularity of this magical device increased, an apparatus was perfected which permitted the pictures to be projected across a room against a reflecting screen. There were no picture "palaces", and the only amusement places large enough to permit a crowd to gather were rather small. In many cases it was necessary to borrow chairs from the nearest undertaking parlor to accommodate those who desired to stay longer than for the brief period required to run through the entire show, usually about ten minutes.

In one of the early discussions of motion pictures, the story is told of a group which had gathered in one of the small picture houses to see motion pictures of the ocean waves coming in to the shore. The pictures were so realistic that those who were seated on the front rows actually bolted, causing much damage to the furniture and to others present.

Since those early days the motion picture has grown to the point where it is generally accredited with being nearly as powerful as the press in its influence upon the life of the American people. The first western pictures were produced way out west in West Orange, New Jersey. Pictures today are produced with settings in every part of the world, and some of the highly imaginative ones with settings of other worlds. There seems to be almost no limit to the possibilities of the picture in presenting life of all types in every part of the universe.

USE OF MOTION PICTURES IN EDUCATION. Although Edison's early dream was the utilization of the motion picture for educational purposes, motion pictures strayed far from that purpose before they again returned to the educational field. The first intensive application of the motion picture to educational procedure was immediately before and during the World War, largely for propaganda purposes. Motion pictures were found to be so valuable during that period, that the close of the War brought into existence many types of educational films and film producers. Henry Ford launched a production program covering large numbers of pictures for educational use, many of which were the best available at that time. The large industrial organizations had found motion pictures to be especially helpful within the organization, and began preparing pictures which could be used to educate the public with respect to the functions of those organizations. Educational film producers sprang up in various parts of the country, the majority of which did not seek or receive the counsel of educational authorities, so many of the films produced were of little or no value in the school. The first use of the motion picture in schools was largely for the purpose of entertaining the student body. In some unfortunate instances very little more is accomplished today.

The period of enthusiasm for the application of motion pictures to the instructional field, from 1914 until about 1920, was followed by a decided slump. Those who had purchased elaborate projection equipment largely upon the representation of salesmen that unlimited quantities of highly educational films would be available at little or no cost, found that the supply of films was not as extensive as had been represented; that many of the so-called educational subjects were not increasing pupil achievement to any measurable extent.

During the early period of enthusiastic use of educational pictures and the period of the slump which followed, certain experi-

mental psychologists and educators had given attention to the possible uses and values of the motion picture in educational procedure. Experiments were conducted in various parts of the country by such pioneers in the field as Weber, Freeman, Johnson, Roach, McClusky, and others. It was found that there were certain definite values to be expected from the proper use of the motion picture, and these findings were instrumental in causing larger and more stable organizations to undertake the production of strictly educational films.

One of the first creditable moves in this direction was made by the Society for Visual Education, with its science and geography films. The next major project was started by the Yale University Press when it began the production of the Chronicles of America Photoplays. These pictures are among the finest historical subjects ever produced, and are used extensively by schools throughout the United States. The Yale production program was followed closely with the announcement of the Eastman Teaching Films to be produced and distributed by a subsidiary of the Eastman Kodak Company, an organization which had gained its financial strength through the development of the motion picture. Other producers came into the field, particularly those who were interested in producing industrial films of an educational nature—films which would give a true story of the various industries to interested groups.

The development of the educational picture in the United States was paralleled to a certain extent by similar development in the European countries. Although the United States is the leading producer of motion pictures of all kinds today, there are many other nations which are applying the motion picture to educational problems in a very effective manner. It is rather safe to state that motion pictures are being used for educational purposes in every civilized country as well as in many countries or localities which may not have achieved that rating. American produced pictures, both educational and recreational, have had their titles translated into many different languages and have been distributed throughout the world. This international use of the motion picture has brought about several problems, the majority of which have been solved without great difficulty.

The schools of the United States are using motion pictures extensively, and probably more schools in this country than in any other are equipped to utilize the service. There are very few of the first class cities in the United States which do not have central-

ized departments or bureaus of visual instruction charged with the responsibility of providing visual aids to the various teachers in their respective school systems. Those cities offer very complete service to their teachers and have coordinated effective visual aids with the curricula so as to get the best possible results. Of the forty-eight states there are more than thirty which have one or more agencies for the distribution of motion pictures among the public and private schools. The various departments of the Federal Government have taken an active part in the promotion of visual instruction or in its direction during the past several years, and are now giving increased attention to this rapidly developing educational field. The Office of Education at Washington has established a clearinghouse service for the assistance of those who come to it for suggestions or for information as to where certain materials may be obtained. The Departments of Agriculture, Commerce, and the Interior have utilized motion pictures extensively in connection with their work. There are many excellent subjects available for loan to schools practically free of charge, which cover the leading developments in the fields of agriculture, forestry, mineral industries, women in industry, and other industrial activities in this country. The Department of Labor has produced several motion pictures dealing with its activities and for the purpose of promoting a more intelligent regulation of industries.

ADVANTAGES AND LIMITATIONS OF SILENT MOTION PICTURES. There are several situations in which the motion picture will serve better than any other type of projected visual aid. With the motion picture camera, one can slow down the action of an athlete for form study, or take pictures of any other rapidly moving object, even at the speed of a rifle bullet. It is possible, therefore, to study thoroughly the action of objects which would be much too rapid for the unaided eye to analyze.

The same instrument may be used to speed up action to the point where a normal life cycle of a plant, for example, can be presented on the screen in a minute or less—action which would be much too slow to be perceived by the eye. Similarly, it may be used to stop the motion of a moving object at any desired point for study. And by use of the animated drawing, it can bring before any group clear representations of action which would be invisible to the unaided eye. A steam turbine, for example, appears to be just a huge metal case in which something is happening to turn it as steam passes through it. Watching it might give the pupil all

sorts of conceptions and misconceptions. However, a simple animated drawing of what happens inside the turbine may be projected to the screen in a manner which will be intelligible to all.

The motion picture camera, with the aid of the microscope, can be used to record and reproduce the normal action of life forms much too small to be seen by the unaided eye. Furthermore, these animalcules in action may be projected to a screen, greatly enlarged, for concentrated group study—a thing which cannot be accomplished in any way except through micro-projection. By this same process, the eye of a fly may be made as large as a balloon; the head of an ant may be enlarged to fill a space six or eight feet in diameter; the blood stream in a capillary can be enlarged to the size of a small brook; and a paramaecium becomes as large in appearance as a small boat.

The motion picture may be used to present animated diagrams or statistical data in such a way that they will form an indelible impression upon the audience. It may be used to provide a brief survey of broad topics. With the various tricks of motion picture photography, it may be used to clarify impressions concerning almost any situation where motion is necessary to convey the message correctly. It can bring all parts of the world to the classroom. It can present in normal motion the many life forms which could not be brought to the classroom and to which it would be difficult or impossible to take classes or other groups for direct contact. It is the nearest approach to the real in studying objects in motion and, in some cases, will prove to be more effective.

It would be unfair to pay all these glowing compliments to the motion picture without calling attention to some of its shortcomings. The motion picture, at best, is but a substitute for the actual experience. If it is possible to study life forms in their natural surroundings, the school journey should be utilized instead of the motion picture. Furthermore, the motion picture should be employed only in those situations where motion is necessary to give the correct impression. A motion picture of an inanimate object is not as satisfactory as would be a good slide, photograph or model of that object.

The motion picture projector is a rather simple combination of gears and gadgets, but some teachers encounter difficulty in operating it. A reasonable amount of mechanical aptitude is required to be able to take proper care of the projector. There is much danger of damage to the film if the projector is not cleaned, oiled, and operated properly. The projection of motion pictures requires a

more thorough darkening of the room than would be necessary for the projection of glass slides. The cost of the equipment and of the service is greater than the cost of still picture projection equipment and service. All these limitations but serve to emphasize the

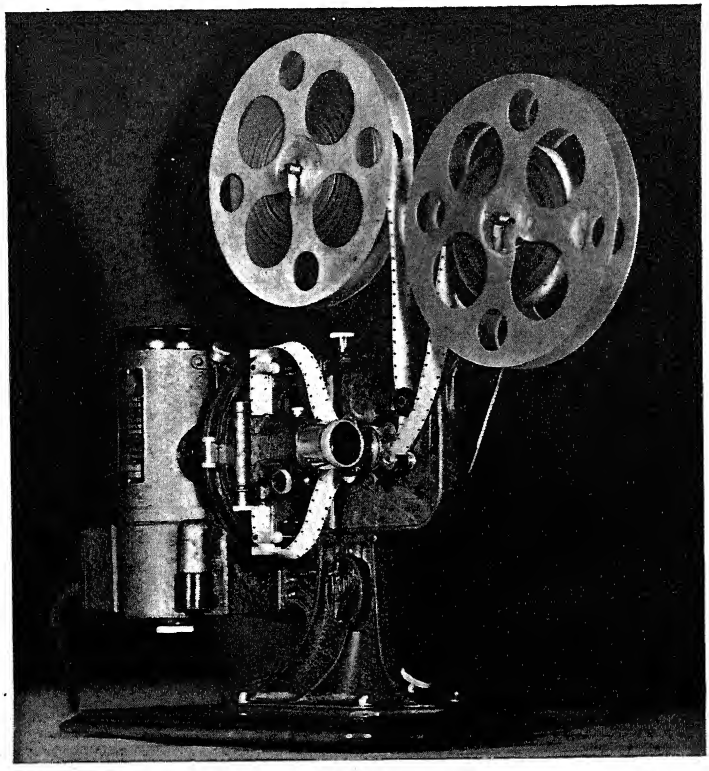


Photo Courtesy Victor Animatograph Corp.

A Silent Motion Picture Projector

importance of using the motion picture only in those situations where motion is required.

It is well, in considering the comparative values of motion and still pictures, to call attention to some of the advantages and limitations set forth by McClusky.*

*McClusky, et al, "Visual Instruction in the Modern School." Syllabus of a proposed text.

Advantages:

1. The moving picture has the unique advantage of depicting action or behavior, with its irresistible illusion of life and reality. It is however, an expensive visual aid and for that reason should be resorted to only when necessary (1) to show activity, which no other pictorial aid can actually portray, and (2) to provide such vicarious experiences as may be brought to us because we cannot get them in any other way.
2. The film has proved valuable to scientific workers by enabling them to reproduce processes and analyze motion and movements for detailed study.
3. The film has value in presenting popular non-technical phases of the subject to those who have relatively little knowledge regarding it.
4. By means of the motion picture and the animated diagram, one can visualize the invisible.
5. The motion picture is very effective in publicity, drives, campaigns for social betterment and similar forms of propaganda.
6. The film is the best visual tool when the continuity of a process involving movement is to be seen.
7. The film is advantageous for purposes of vivid summary or general survey of a broad topic.
8. The film is unique in revealing, for the first time in the history of human learning, things which are too slow or too fast to be seen by the human eye.

Limitations:

1. The film with its rapid-fire method of projection must be stopped, slowed up, or shown a second or third time if any real study and analysis of the content is to be achieved.
2. Some moving pictures have a tendency to relegate the teacher into the background.
3. Continuity is definitely established. This may not fit the teaching plans but is not a serious problem to the teacher who is trained to use motion pictures effectively.
4. Films are perishable and do not stand wear and tear like some other visual aids.
5. The film, to be effective in the classroom, should be

previewed by the teacher and followed up by definite study. Sometimes the teacher cannot get the film when it is needed most.

6. The film is used too often as a substitute for, rather than a supplement to, other methods of presentation.

HOW TO USE SILENT MOTION PICTURES. The field of discussion opened by the heading for this section would provide ample material for many pages of discussion. It shall be the aim here, therefore, to point out a few of the general rules to be observed in getting the best results from motion pictures under normal conditions. Special conditions will require alterations to conformity.

1. The motion picture should be used where it will contribute most to the understanding of the subject; i.e., to introduce the subject, as a part of the laboratory or study period, or as review.

2. The picture should be used directly in connection with the teaching of the subject to which it pertains; i.e., the motion picture, "Dixie," should be used during the week or weeks devoted to consideration of the War Between the States.

3. The teacher should preview the film in order that there may be thorough familiarity with the content. Points which are not entirely clear to the teacher should be checked in advance, so questions from members of the classes may be answered intelligently.

4. The showing of the film should, in most cases, follow an oral introduction or discussion, during which certain unanswered questions will be left for the film to answer.

5. In the case of silent films, explanatory discussion during the showing has been found to be helpful in some instances, if the discussion is pertinent. If not, omit it.

6. Usually, it will be advisable to show the film twice; once without stopping and with minimum comment, followed by open discussion, and the second showing to answer questions raised during the intervening discussion.

7. Use the film reverse and stop-on-film sparingly and only to emphasize points which require such emphasis. Reversing the film, unless accomplished properly, may become merely a funny stunt, thus losing its potential value in analysis of motion.

8. Whenever possible, use the pictures with but one class group at a time, and use them in the room to which the class is accustomed. Moving the class to another room, or with another class or section, is apt to become little more than a picture show, except in situations where a skillful auditorium teacher is in charge.

9. Follow the use of the pictures with an adequate test or other checking device, to determine the progress made. This procedure will have a tendency to develop among class members the seriousness of purpose of the picture presentations.

10. Make certain that the film and equipment are forwarded to the next teacher or school according to schedule. Report any difficulties in projection, such as breaking the film, irregularities in projection, etc., to the person in charge of the visual instruction service for the building or school system.

11. Plan for the next picture well in advance, relating it as closely as possible to the topic with which it is to assist.

TYPES OF FILM. There are two types of film in general use, one of which is used almost exclusively in the theatrical field, and the other almost exclusively in the field of education. One is nitrocellulose or inflammable film, and the other is cellulose acetate or "safety" film. The theatrical motion pictures in the main are printed on nitro-cellulose film. This film is rather highly inflammable and requires extreme care in handling. It is a little more durable than "safety" film and costs a little less. Theaters are equipped with fire proof projection rooms and also fire prevention gadgets of various kinds, so there is no great hazard encountered in using this film in theaters. It is more economical and is used for practically all theatrical productions.

The other type of film is made of acetate of cellulose and is the slow-burning or "non-inflammable" film, known as "safety" film. Inasmuch as the majority of the schools which use motion pictures do not find it convenient to project them from a booth or projection room, the "safety" film is much more desirable for them. All 16-mm. motion pictures which are released for educational service are printed on "safety" film. The majority of the 35-mm. silent and sound pictures which are available for schools are on "safety" film also. Schools which use 35-mm. motion pictures in portable projectors should make certain that the films are of the "safety" type, for there is a great hazard in using the inflammable films outside of suitable projection rooms. In some states and in many cities the use of nitrate films except in accordance with very strict regulations, is a punishable offense.

The use of the 16-mm. "safety" film in all the usual 16-mm. motion picture projectors does not affect fire regulations of the state or city and does not affect the insurance rating on the building in which the pictures are projected. There may be a few freakish

situations which are not in accordance with the general rule, but if so there is certainly no justification for such a ruling. The "safety" film will burn if subjected to continuous flame or heat of an intense nature, but certainly will not burn to an extent that there would be any danger of fire from it during projection.

SIZES OF FILM IN GENERAL USE. The history of the motion picture has recorded many different sizes of film ranging all the way from 8-mm. film to film 70-mm., or approximately 2¾ inches in width. There have been films 8, 9.5,. 12, 16, 28, 35, 50, and 70 millimeters in width. Many of these have disappeared from general use due largely to the fact that standardization has been centered upon the 16-mm. film for non-theatrical use and the 35-mm. film for theatrical purposes.

The recently developed 8-mm. motion picture film, which has become so popular for amateur use, offers some interesting possibilities to those schools which desire to experiment with film production. Teachers who wish to prepare motion pictures to illus-

Photo Courtesy Bell & Howell

8-mm Motion Picture Camera

trate certain lessons in their courses will find this small film, used in a good projector, to be both inexpensive and satisfactory for small groups. Furthermore, it may be used to produce natural color films, also at low cost. There is no extensive library of 8-mm. educational films available at present, but it is possible such subjects will increase from year to year. Those who plan to use this size of film will find it extremely important to secure cameras and projectors of highest quality, as these instruments must be both accurate and dependable if satisfactory results are to be achieved.

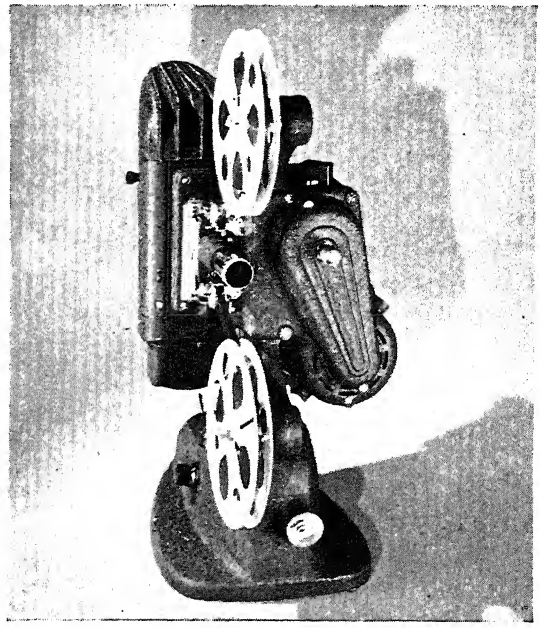


Photo Courtesy Ampro Corp.

8-mm Motion Picture Projector

The 16-mm. motion pictures, which have become the educational standard for classroom use were first developed as an answer to the problem of a cheaper way in which to produce sales promotion films or films to be used within organizations. The early types of projection equipment did not give the best of results, and many who witnessed 16-mm. motion picture demonstrations twelve or fourteen years ago were not impressed by their possible use for schools.

Since that time, however, more powerful projectors have been built and the 16-mm. motion picture film can be projected in the average classroom just as satisfactorily as the 35-mm. film. As a matter of fact, some of the 16-mm. motion picture projectors now available are capable of giving better projection in the classroom than the majority of the portable 35-mm. silent projectors.

There are many advantages of the 16-mm. motion picture for educational purposes. In the first place, it is much cheaper than the film of 35-mm. size, in purchase price and in the cost of transportation. The fact that it is safety film means that it can be shipped by ordinary parcel post, in small paper cartons at one-quarter or one-third the cost of shipping a comparable reel of 35-mm. motion picture film.

Another great advantage of the 16-mm. film is the ease with which it may be handled. It is light in weight so may be carried from place to place without difficulty. Furthermore, the projection equipment for the use of this film has been simplified to the extent that any teacher with but a few minutes of instruction will be able to operate it successfully. It is certainly much easier to operate than some of the older classroom projectors for 35-mm. films. In addition to the simplicity of operation which characterizes the 16-mm. motion picture projector, these projectors are extremely light in weight and may be carried from one room or building to another even by a pupil in the intermediate grades. Another advantage is that they may be attached to any standard house lighting circuit without causing undue strain upon the wiring. The average circuit protected with a 10-ampere fuse will be sufficient to operate any of the 16-mm. silent projectors.

Until a few years ago, all educational sound pictures were either 35-mm. sound on film or 16-mm. film with sound recorded on a disc. There was a feeling for a few years that it would be impractical to record sound on 16-mm. film. The chief difficulty was that of finding a place on the film for the sound track. This problem was solved by omitting the sprocket holes on one side of the film. It has been found entirely satisfactory to use film which has the sprockets on one side only, as the better makes of 16-mm. sound motion picture projectors are built with such accuracy that very little pull is required to move the film from one frame to the next at the aperture gate.

Another problem confronting those who developed the 16-mm. sound film was that of reducing the sound track from its original length of 1000 feet on 35-mm. negative to the new and shorter

length of 400 feet on 16-mm. positive. This reduction has been accomplished optically with marked success and the recording and reproducing range on 16-mm. film now approximates that of the ordinary 35-mm. sound films. Some of the new types of sound recording such as the mirrophonic process used by Western Electric and the ultra-violet higher fidelity process used by RCA actually increase the range far beyond that which has been accomplished by reduction to 16-mm. film. On the other hand, first class 16-mm. reductions cover the range of normal sounds in a thoroughly satisfactory manner. In many cases, the person with an ear untrained to notice minute sound variations will be unable to detect whether the sound comes from 16-mm. or 35-mm. film.

As a result of perfecting 16-mm. sound films and projection apparatus, the 16-mm. sound film is taking the place of the 35-mm. film for educational purposes, except in those situations where it is desirable to use theatrical films for combined educational and recreational purposes. This situation is changing inasmuch as some of the theatrical producers are now reducing their best films to 16-mm. for use among schools. It is expected this change will become more general, thus gradually eliminating the use of 35-mm. equipment among schools except where it is necessary to project pictures longer distances and to greater size than can be accomplished satisfactorily with 16-mm. film and projection equipment. Many schools are using both types of equipment in order that they may make use of all available worthwhile films.

The 35-mm. motion picture, which is the standard theatrical size and which is a little more than twice the width of 16-mm. film, is being used less and less among schools and other educational organizations for the projection of silent pictures. The ratio of silent 35-mm. usage to the use of silent 16-mm. films seems to be about one to ten, based on the distribution of films of both sizes by such agencies as the Y. M. C. A. Motion Picture Bureau, the U. S. Bureau of Mines and other large non-theatrical distributors of silent films. It is interesting to note in this connection that the ratio of silent motion picture projectors of both sizes to sound motion picture projectors in use among schools is approximately eight to one, although this ratio is changing in favor of the sound projector from year to year. Practically all 16-mm. sound motion picture projectors are so constructed that they will project both silent and sound films properly. This means that those projectors must be equipped to operate at two speeds. Sound films move through the

projector at the rate of twenty-four frames per second, requiring approximately eleven minutes for the projection of one full reel of 400 feet. Silent films move through the projector at the rate of sixteen frames per second, requiring approximately fifteen minutes for the projection of one full reel.

The sound-on-disc equipment for motion pictures, which was used formerly by theaters and by schools, is no longer used by either to any appreciable extent. It became obsolete among theaters some years ago and is rapidly disappearing from the school field. In fact, there are no distributors of motion pictures who offer sound-on-disc subjects.

PROBLEMS IN THE USE OF THE MOTION PICTURE. There are some problems to be given consideration in connection with the use of the motion picture. The majority of these are minor rather than major, but are extremely important. First of all, those who are using motion pictures or who are planning to use them should become thoroughly familiar with the available projection equipment. An operator who does not understand the care and operation of equipment is apt to cause damage to the film. This will be charged to the person causing that damage inasmuch as it would be unfair to expect the owner of the film to assume it.

Another problem which will need to be given consideration is that of the cost of film, either outright purchase or on loan, and the transportation of that film from the source of supply to the school which desires to use it. A few years ago it was necessary for schools in certain sections of the United States to send long distances for the films they desired to use. This situation has been corrected to a certain extent by the inauguration of new service bureaus in various sections, so nearly any school in the United States can now secure service within a distance of 500 to 600 miles.

The physical equipment of the building or rooms in which the motion pictures are to be used will need to be given some attention. The majority of the older buildings and some of the new ones are not equipped with floor plugs or electrical outlets to accommodate projection equipment. This is excusable in the older buildings, but no building which has been constructed within the last ten years should be without suitable outlets. If such a situation exists, it is almost necessary to have a competent electrician prepare outlets which are in easy reach of those who operate the equipment. It is not desirable to simply drop an extension cord from one of the lamps in the room inasmuch as it is inconvenient to turn out the lamps in

the other sockets and will cause a great deal of confusion in the classroom. All the physical equipment incidental to projection should be made as convenient as possible in order to avoid the creation of an artificial teaching situation in the room each time the equipment is set up for use.

The arrangement of the equipment within the classroom itself and the seating within the room will be important in the showing of motion pictures or other projected material. Whenever possible the pupils in the room should be facing the direction in which the room is longest. The best projection results are secured in long, narrow rooms as those students who are at wide angles from the screen do not get a clear impression of the image projected. The room should be darkened as thoroughly as possible, as any interfering light will tend to detract from the value of the picture itself. It is true that some of the more powerful projectors can be used in rooms which are reasonably well lighted, but there is apt to be a strain on the eyes of the pupils watching the picture, and it is quite probable the picture itself is not as distinct as should be required. If it is impossible to darken the various rooms of the building in such a way that each will be reasonably satisfactory for projection, it would be better to simply devote one room to projection purposes, darkening it as thoroughly as possible. Classes could be taken to that room for the motion picture presentations, but this again tends to detract from the normal teaching situation and may develop into a "picture show."

The projection equipment, including the screen and such other accessories as may be needed, will require a certain amount of care which should be planned and executed according to the plan. It is hardly necessary to state that unless there is a fixed responsibility for a certain piece of equipment which is used by many people, the equipment will soon become useless to all. If the school unit or system is not large enough to have a visual instruction department which will take care of the physical equipment, it would be well to appoint some competent member of the staff to handle this and release that person from certain other duties to compensate for the time required. If this does not seem desirable, undoubtedly there are one or two advanced students in the school who are mechanically inclined and who would be pleased to the utmost with the opportunity to become responsible for the care and operation of a projector. It has been found in some instances that students of this type are much more conscientious and thorough in caring for the

equipment than members of the teaching staff who have many other duties to perform.

EVALUATION OF THE MOTION PICTURE FILM. There are certain matters which should be considered rather carefully before plans are made to use a motion picture in connection with the instructional program. It is well to ask first whether or not motion is necessary to present the message. Certainly a motion picture of the Capitol Building in Washington, D. C., would present no advantage over a projected still picture of the same building, unless there should be some action in the picture which is necessary. A good plain or tinted glass slide of the building would be much more satisfactory, would be easier on the eyes of the pupils, and could be left on the screen as long as it might be needed for discussion purposes. Motion is desirable, of course, in any situation where the recording of natural motion or animation is needed to give a clear impression of the topic under discussion. A simple rule to follow, therefore, is to use motion only where motion is necessary.

Another simple rule which is becoming more and more important to visual instruction workers is that the film should not be used unless it makes a definite contribution to the teaching of the subject. If a film on cattle raising on the Great Plains of the United States is to be shown to a class in geography or in agriculture, it should be used in connection with the study of that section of the country or the study of cattle raising by the group, and not simply brought in at any time to be shown to the class without any direct reference to the subject itself. The same film used at the proper time would be extremely valuable, whereas the improper use of it might be a total waste of time. There are many films posing as educational subjects which should never enter a classroom. In some cases the information contained in them is irrelevant and in others it is incorrect. Of course, there is never a logical excuse for bringing into any classroom as a visual aid anything which is untruthful or incorrect in any way. It makes just as strong an incorrect impression as the proper visual aid would make correctly.

As suggested above, there are many so-called educational films but a more limited quantity of films which are truly educational in their makeup. There are many subjects which are semi-educational and many of these can be applied at the proper time and place with reasonably good results. Also, there are many industrial films which have certain educational values. The films of the mineral industries

produced by the U. S. Bureau of Mines, the films of various industries produced by the General Electric Company, the films of the agricultural industry produced by the U. S. Department of Agriculture and similar educational subjects produced by smaller organizations throughout the United States can be used to good advantage if they are selected carefully and presented properly. Too many times the schools which use industrial films simply order them for any available date and attempt to make use of them when they arrive. This is just as unsatisfactory a procedure as it would be to use educational films when they do not fit into the schedule.

16-*mm. Silent Motion Pictures*

ADVANTAGES AND LIMITATIONS. The preceding discussion has mentioned some of the advantags and a few of the limitations of the 16-mm. silent film. Economy is one of the greatest advantages, and limited size and distance of projection would be the greatest disadvantage of the 16-mm. film. However, the limitations in size and distance might be considered an advantage inasmuch as they have in some instances forced the educational motion picture into the classroom, where it really belongs. The discussion which follows will call attention to some of the favorable and unfavorable aspects of the 16-mm. film.

COST OF MATERIALS. The cost of the 16-mm. silent motion picture film is very reasonable. The best educational subjects in existence can be purchased at an average cost of approximately $25.00 per reel. (See list of sources, page 194.) There are some highly specialized subjects with limited distribution which are more expensive, and there are a few subjects for less. However, it is advisable in most cases to select films from a reliable and reputable producer inasmuch as the variation in cost is too slight to run the risk of getting materials which are not of the highest quality.

The majority of the service bureaus which offer to lend visual aids to schools have individual or group service fees which will provide standard 400-foot reels of 16-mm. silent films at an average cost of approximately $1.00 plus transportation charges. In most cases this means that any school may secure the use of a 400-foot reel of the best educational motion pictures for one full day by paying a service fee of $1.00 plus the normal transportation and insurance charges. In a few instances this fee is less and in some instances it is more. Industrial and scenic films are available with-

out charge when ordered directly from the industries which produce them, and there is usually a small service fee charged by the visual instruction bureaus which have accumulated assortments of industrial films. In most cases the nominal charge made by the service bureaus will be less than the postal charges for delivering the films from the producers and returning them. It is usually advisable, therefore, to secure the film service from the nearest service bureau. The service fees are as reasonable and the materials themselves are of high quality.

Those who may be interested in producing their own motion picture subjects will find that the costs vary somewhat in accordance with the difficulty of securing good pictures of the subjects included. It is comparatively inexpensive to photograph any subject which is normally to be found in good light out of doors. It may prove to be rather difficult and expensive to photograph subjects which require the use of artificial lighting, animation, or other special devices to record the picture properly. More attention will be given to film production later in this book.

TRANSPORTATION CHARGES. One of the greatest advantages of the 16-mm. motion picture is the extremely low cost of transportation. A reel of 16-mm. film may be shipped entirely across the continent at a cost of fifteen or twenty cents. It would cost three or four times as much to ship a reel of 35-mm. motion picture film. If the films are to be shipped long distances, there will be very little difference between the costs of parcel post and express. Some postal authorities fail to give proper attention to film shipments which must be delivered promptly if they are to be of value, but in many cases the difficulty can be solved by explaining this situation to those concerned. Both postal and express employees are usually ready to cooperate to the fullest extent in providing the best of service, but express shipments require no additional insurance. Also, return express shipments are accepted at half rate.

CURRENT DEVELOPMENTS. It is interesting to notice that there are now many excellent 16-mm. motion picture subjects available for school use, and that the majority of the silent films in production are being planned for film of 16-mm. size. It is but seldom that a 35-mm. silent motion picture subject is announced in current publications, whereas many new 16-mm. silent subjects appear in each issue of the leading magazines in the field.

CONVENIENCE. The majority of the conveniences of the 16-mm. motion picture have been suggested earlier. The two great conve-

niences of this type of film are the ease of handling and the ease of projection. There are two factors which contribute liberally, the light weight of both films and equipment and the simplicity of operation of the projection equipment.

16-MM. SILENT MOTION PICTURE PROJECTION EQUIPMENT. One of the great advantages of the 16-mm. motion picture is the ease and economy with which it may be projected. The majority of the projectors available for use in schools are extremely simple to operate, require a minimum of attention, and are readily portable. Furthermore, the best types of projectors will give projection results which compare favorably with those secured by the use of 35-mm. film projection equipment.

There will be no attempt, in this publication, to classify the various projectors available. All the leading projectors offered for sale have certain points of favor and certain limitations. These projectors range in price from $95.00 to $280.00, depending largely

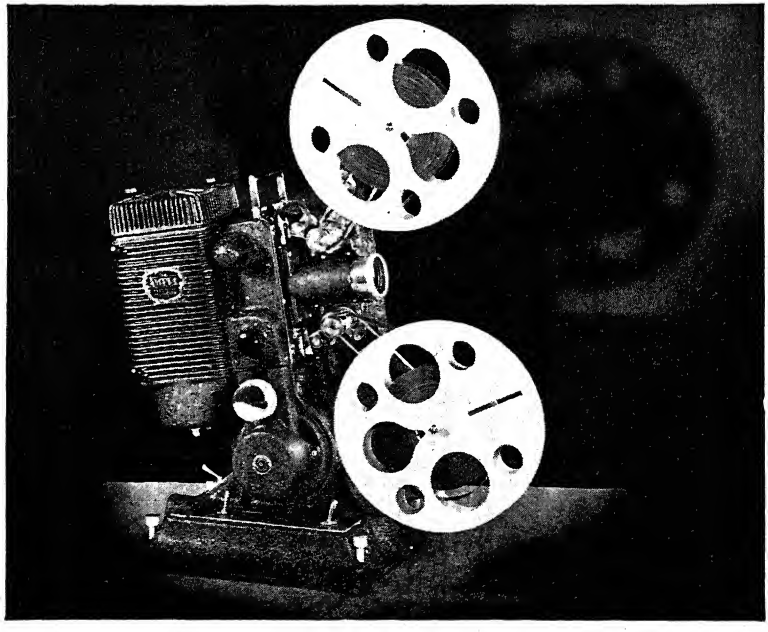


Photo Courtesy Ampro Corp.

16-mm Silent and Convertible-to-Sound Motion Picture Projector

upon the completeness of the instrument, quality of lenses, strength of illuminant, and the like. There are many small projectors available, ranging in price from $3.98 to $75.00, but the majority of the projectors which sell at a price below $60.00 are merely toys and should not be purchased for school use. In addition to their limitation in projection ability, quite often they are poorly constructed and will have a tendency to damage the film while being projected.

SELECTION OF EQUIPMENT. Those who may be considering the purchase of 16-mm. motion picture projection equipment will do well to give careful consideration to each of the various makes available. It is true that each manufacturer is proud of his product and sees in it all the advantages possible to incorporate in one instrument, but there are really reasons for the differences in mechanical construction and price and those reasons can be discovered, in most instances, by comparison.

Some consideration should be given to the type of room in which the projector is to be used most frequently. In the majority of cases, it is advisable to use educational films in the classrooms. If this is not possible, the next best plan is to equip one room for projection and reserve it for that purpose, taking classes to it when advisable. In such cases—in the special room or in a classroom which can be well darkened—almost any of the more or less standard projectors will be entirely satisfactory. If it should be that the equipment is to be used in a very large room or auditorium, or in a classroom which cannot be rather thoroughly darkened, it will become necessary to select one of the more powerful projectors, utilizing the 500- or 750-watt lamp and with high quality optical equipment.

All distributors and sales organizations are ready and willing to arrange for demonstrations, if they are assured of the sincerity of purpose of those requesting such service. The last word of the preceding sentence is used advisedly. The firms or individuals who arrange for demonstrations of equipment are performing a real service for those interested in the demonstration. It is expensive to travel from place to place and expensive to purchase and maintain equipment for demonstration use In fairness to local firms or traveling representatives, therefore, it is urged that requests for demonstrations be withheld until there is an active interest in the purchase of equipment. It is decidedly unfair to ask any individual or organization to ship or bring expensive equipment and materials to any school or other organization merely to add variety

to an otherwise dull program. Schools which request such service should be willing to pay at least the expenses of the demonstration if equipment is not purchased soon after.

It is true that some representatives cruise about over the country looking for business and will offer to demonstrate while in the vicinity. In such cases, those interested in demonstrations should permit them and should consider themselves under no obligation to purchase or to pay travel expenses. Frequently, such demonstrations will arouse an active interest in the use of the equipment and materials.

Those who desire descriptive material concerning projection equipment of various kinds will do well to get in touch with an agency which represents a manufacturer, or write directly to companies manufacturing the equipment, as listed on page 205. These companies will provide the information promptly and will refer the request to a local representative, who will be ready to arrange for such special demonstrations as may be desirable.

ACCESSORY EQUIPMENT. There are certain accessories which should be secured at the time of the purchase of the projector. First of all, no salesman should be careless enough to permit a school to purchase a projector of any sort without an extra lamp. Projection lamps will give forty to one hundred hours, or more, of satisfactory service if handled carefully and connected to the proper current. However, it is possible to break a lamp instantly by jarring it, dropping it, or subjecting it to other accidental or careless treatment. If another lamp is not available readily, there may be several days of delay in securing one. An extra lamp is an absolute necessity and should be on hand at all times.

Additional equipment which should be on hand for emergencies would include a film patching and rewinding outfit, a dust cloth, a bottle of projector oil, an extension cord, a small bottle of benzine, and a projection screen of suitable size and type. The names of companies which have such equipment available will be found on pages 204 and 205, and a discussion of the various types of screens is given on page 121 to 124.

CARE OF THE FILM. The first essential in caring for the film is to see that the projection equipment is clean and properly adjusted. Carelessness in handling the projector can cause much damage in a short time, which damage should be charged to the person or school causing it. The film should be run through the projector at

normal speed and should be reversed only when necessary to clarify some process or sequence of action. The stop-on-film device, which is provided on all the better silent projectors, should be used sparingly. If motion is necessary to convey the message, the picture should be shown in motion and not as a combination of motion and still pictures. There are some instances, of course, where the still projection of a motion picture frame will be advisable, but in those instances the still projection should be as short as possible, to prevent possible damage to the film by drying or warping.

The film should be handled as carefully as possible at all times. It should be removed from the shipping can with care, and threaded into the projector in the proper manner. After it is used, it should not be rewound except for repeat showings and should be placed back in the shipping can when not in use. It should not be permitted to touch the floor or other dusty part of the room during projection, rewinding, or other handling. Dust damages film quickly.

Breaks in the film should not be repaired by amateurs, unless the film is to be shown again. If repairs are made, they should be made as carefully as possible, and directly in accordance with the instructions provided with repair outfits. Careless repairing of the film, or repairs made without the use of proper equipment and cement, may cause several feet of film to be damaged the next time the picture is projected. Broken films should never be pinned together with pins, as there is danger of injuring seriously the hands of inspectors, or damaging the rewind mechanism.

Films should be kept away from extreme heat and should not be stored in rooms that are too warm. The 16-mm. film is not readily combustible, but abnormal warmth will cause it to dry and become too brittle for satisfactory projection. A cool moist place will be best for the storage of film for any period longer than a day or two.

After films have been used, they should be returned to the source from which they came in the original containers, packed carefully. If they are to be shipped through the mail, they should be insured at full value (usually about $25.00 per reel). The shipment should be addressed clearly, with information as to the contents of the package.

Producing 16-mm. Educational Films

The heading for this section is really a misnomer, inasmuch as no attempt will be made to go into the many details incidental to the

production of educational motion pictures. However, there are some situations in which it is advisable to produce materials of special local significance. The suggestions which follow, therefore, are offered in the hope that they may be of assistance to the amateur who desires to construct special materials for his or her peculiar situation. Furthermore, the suggestions may be of interest and assistance to those who desire to produce amateur athletic, scientific or propaganda subjects for local consumption.

Some instructors in vocational agriculture have found it advisable to prepare motion pictures of summer farm activities, for use during the winter, when these activities cannot be observed in connection with the growing of crops or raising of livestock. Some natural science instructors have found it advisable to construct films of local bird and animal life. Coaches have found it advisable to produce films of outstanding athletes and teams, to be used in form study and in advertising the athletic activities of the school. Colleges and private institutions have found the motion picture to be a valuable advertising medium and are using it increasingly for the purpose of bringing their institutions to the attention of those who should be interested. Some are producing educational films of great value.

SELECTING THE SUBJECT. One of the first questions to ask is whether or not motion is necessary. If not, a good slide might serve the purpose better. Next, it will be well to ascertain whether or not such a subject has been produced. If the subject has been produced somewhere else, professionally, it would be better and cheaper to purchase a print of that subject. The next problem will be to determine whether or not the various scenes required for the production are accessible to the camera. The subject should have a real purpose and that purpose should be defined clearly before production is started.

PREPARATION OF OUTLINE OR "SCENARIO." It is essential that a plan of production be determined. Much film will be wasted if scenes are shot without relation to the plan of the picture, and much additional time will be required to fit these random shots into the production. After selecting the subject, therefore, the next essential is that of outlining, definitely, the content of the picture. Scenes should be selected with a view of their relation to the central purpose of the production.

Once the required scenes have been determined, these should be arranged in logical sequence, and the production viewed as a

whole. If it is then found to be satisfactory, the plan can be turned over to the person with the camera, for the shooting of the picture.

SELECTING A SUITABLE CAMERA. The choice of a camera for this type of production will be determined by the material to be produced. If all the material planned is to be photographed in normal action, almost any of the inexpensive motion picture cameras will be satisfactory. As variations become necessary, the need for care in selecting the equipment is increased. If slow-motion pictures are contemplated, a camera with variable speeds is essential. If nature-study subjects are to be photographed at long range, lenses of different focal lengths will be needed. If interior pictures are to be taken, it may be necessary to use lenses with greater speed than ordinary lenses.

Good cameras will range in price from $60.00 upward, with the average all-purpose camera ranging in price from $150.00 to $400.00, with a complete assortment of lenses and accessories. The firms which are listed on page 205 are producers of 16-mm. motion picture cameras and will be ready to offer suggestions as to the most desirable equipment for specific situations. As with the projectors, it will be well to give comparative attention in selection.

SELECTING FILM STOCK. The selection of film to be used for any given situation should be given some consideration. The ordinary negative stock should be used for those pictures which are to be used for several prints. The majority of the amateur producers, however, will not have need for additional prints and will find the reversible film to be more economical. Prints can be made from the reversible film, and the process is reasonably satisfactory. The reversible film, as the name suggests, is converted from negative to positive in the processing, and comes back to the photographer ready for projection.

The reversible film is divided into three principal classifications: orthochromatic, panchromatic, and super-sensitive panchromatic. The first is being replaced by "Verichrome" and "Plenachrome" film, which are satisfactory for all general purposes. The panchromatic film is used extensively for pictures where reasonably good light is available for the exposure. The super-sensitive film should be used in poor light or for pictures under artificial light, as it is much more sensitive to artificial light than is either regular or panchromatic film.

There are natural color films available which add much to the value of those subjects in which color is important. The color films

are a little more expensive than films for photographing in black and white and may not be duplicated as easily. The proper projection of color film requires stronger illumination than is necessary for projecting ordinary film, but the new projectors with 1000 and 1200-watt lamps project color well even in large rooms. It is seldom desirable to combine ordinary and color film in the same subject.

"SHOOTING" THE PICTURE. After the scenario has been arranged and the equipment and film selected, the important task is that of taking the scenes to be included. There are a few simple rules to be followed which will be of assistance to the amateur, and these are mentioned below. Experience is a dear teacher and those who operate the camera without first giving attention to certain simple suggestions may find that very expensive film has been wasted.

1. Use a reliable exposure meter to determine the proper lens setting. This cannot be over-emphasized and such a meter should be used for each different situation. Light values are difficult to guess, even for the professional.

2 Keep the lenses immaculately clean. The least bit of dust or oil on the surfaces of the lenses will have a tendency to distort the true picture. A lintless linen cloth or a piece of lens cleaning tissue will be satisfactory for cleaning.

3. Keep the camera clean and well oiled. The very accurately machined parts of the mechanism must have ordinary care in cleaning and oiling if the best results are to be obtained. Follow the instruction book with the camera.

4. Hold the camera steady at all times. This can be accomplished only by using a sturdy tripod, which is almost as necessary as a camera if good pictures are to result. It is almost impossible to hold any motion picture camera steady in the hands and it should not be attempted except in extreme cases where it is impossible to use a tripod.

5. Make complete scenes; not bits. A simple rule to follow is to count slowly to ten for any scene, increasing the length of the scene as may be needed to complete the picture of the action to be recorded. Short exposures are unsatisfactory and will waste much film.

6. Shoot action shots at an angle. Pictures of rapid action should be photographed at an angle of approximately 30 degrees,

with the action moving toward the camera. Pictures taken at right angles or directly behind or in front of the action are usually unsatisfactory.

7. Use filters whenever possible. A filter will tend to give a more nearly true recording of color gradations and will result in smoothness of detail which is not possible without.

8. Do not "pam" the camera. It is best to set the camera in a stationary manner and let the action move through the field of the lens. Turning the camera from one point to another while the picture is being taken, except at very high speeds, will produce a jerky result.

9. Use half-speed or slow motion variations only when necessary. If it is desirable to slow down the action of the subject, pictures may be taken at 32 or 64 frames per second. Football pictures seem to be best at 32 frames per second, as normal action is too rapid for careful study of the plays. The half-speed pictures have but a minor place in a film, except for variety.

EDITING THE FILM. After the films have been exposed and processed, it will be necessary to "edit" them. The scenes will be joined together without titles and it will be necessary to insert proper explanatory titles ahead of each scene. The following suggestions may be of assistance.

1. Cut out all inferior scenes. If some of the exposures have not been entirely satisfactory, throw them away and re-take them, rather than to spoil a good film by leaving them in it.

2. Use attractive titles. Cheap and irregular titles will spoil an otherwise satisfactory subject. Titles can be made, but it is usually more satisfactory to have them prepared by an experienced title maker. Furthermore, a good title maker will be able to make suggestions as to the most attractive way to arrange the titles. There are several organizations which will prepare the titles at the usual commercial rates—25c to 45c for ten words or less—and will assist with the editing at a nominal additional charge.

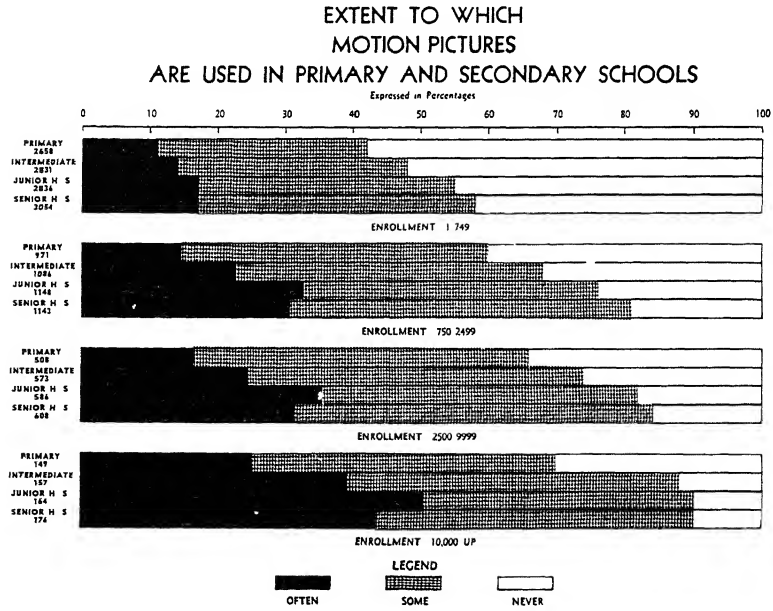
3. Splice the film carefully. Good splices are essential if the film is to operate smoothly in the projector. Follow the instructions with any good splicing outfit.

4. Do not show the film until edited. The desired effect of many amateur productions has been jeopardized by showing the pictures before they have been titled and edited. An unedited picture is almost certain to leave a poor impression.

5. If the picture is to be used extensively, have a "dupe" negative prepared from which additional prints may be made, and save the original. If it is not to be used more than forty or fifty times, the duplicate print will not be necessary.

35-*mm. Silent Motion Pictures*

Very little attention has been given to 35-mm. silent motion pictures in this handbook inasmuch as films of that type are being used less and less among schools. The 16-mm. motion picture films and equipment have replaced the 35-mm. silent films in the majority of the schools, and there are few situations in which 35-mm. silent subjects are being produced. Those who may be interested in using 35-mm. motion picture service for any special purpose will be able to secure used films and equipment at very reasonable rates, but will find that the transportation charges on 35-mm. films are extremely high in comparison with the cost of shipping 16-mm. silent subjects. Furthermore, the quantity of good 35-mm. silent



Graph Courtesy Office of Education (1936 *Survey*)

educational subjects is so limited that the average school will not be able to get what it wants on that size and type of film.

Screens for School Use

Satisfactory projection of pictures of all kinds requires first of all a screen with a reflecting surface suitable for the situation. There are many different types of screens available with trade names of every description. There is a rather general misconception of screens, as there has been of projectors, in that some screens are called "day light," whereas there is no screen which will give entirely satisfactory service when outside light is interfering to any great degree. There are some screens which have higher reflective qualities than others, and the purpose of the following discussion will be to call attention to some of the advantages and limitations of these various types.

There are two general types of screens: (1) those which reflect the picture, and (2) those which transmit the picture. The first type is called the opaque screen and the second, the translucent. The reflecting or opaque screen is used most generally by schools and other educational organizations although the translucent screen is used in some situations where it is advisable to have both the projector and the screen at the front of the classroom and is further necessary to compete with interfering light.

In the case of the opaque screen, the projector is placed usually somewhere toward the back of the classroom with the screen hanging at the front of the room. The required distance from the screen to the projector will be determined by the size of the screen and the focal length of the lens used.* Ordinarily the classroom screen is from 3x4 feet in size to 6x8 feet in size, and any screen within the limitations of those dimensions will be reasonably satisfactory. Too large a screen should not be used inasmuch as it will have a tendency to tire the eyes of those pupils who may be obliged to sit close to it. At the same time, the screen should be large enough to provide a clear picture from the back of the room.

BEADED SCREENS. The beaded screens which have been developed within the past few years and which are used extensively in schools are similar to other screens except that the surface is covered

*Screen image tables for single and double frame filmslides, 16-mm. motion pictures, and glass slides will be found on pages 210 and 211.

with small glass beads. This type of screen has the highest direct reflective qualities of the three general types—beaded, silver and mat white—but the projection at various angles in the room is not entirely satisfactory. If a beaded screen is to be used at one end of a long narrow room it will be entirely satisfactory. On the other hand, if it is to be used on one side of a short or square room, those who are seated at wide angles from it will receive a poor reflection of the picture. Tests which have been conducted by the Electrical Testing Laboratories in New York City indicate that the beaded screen gives the brightest picture for all angles up to 12 degrees; the silver screen is satisfactory at angles up to 30 degrees; and the mat white surface should be used in situations where there will be angles greater than 30 degrees. In most cases the angle of reflection will not be greater than 30 degrees so either the silver screen or the mat white will prove to be satisfactory. The chief claim for superiority on the part of the beaded screen is its brilliance of reflection through a rather narrow angle.

SILVER SCREENS. Silver screens, as mentioned above, are screens which have a metallic coating. These screens are flexible and will permit rolling without damage to the surface. The angle of reflection from the silver screen is greater than the angle of reflection from the glass beaded screen, but has certain limitations. First, unless the screen hangs perfectly straight, without the slightest wave appearing on the surface, it distorts projected pictures, which does not occur with either white or beaded screens. Second, silver screens are commonly referred to as being color selective, since some of the finer coloring is lost when projected upon them. Silver screens are, therefore, becoming less popular since colored film is gaining in popularity.

WHITE SCREENS. It has been found that a screen which has a white surface does not provide the brilliant reflection one would secure from either the beaded screen or the silver screen, but the reflection at an angle of from 30 to 60 degrees is brighter than from the beaded screen, making this type of screen unusually satisfactory for the classroom which is approximately square in shape. Many who project glass slides and filmslides prefer this type of screen and base this preference upon their feeling that the surface which is not so highly reflective is less tiring to the eyes of pupils. Furthermore, the projection of colored materials is more accurate in reproduction when the white surfaced screen is used.

Some of these screen may be washed with ordinary soap and water, which is an advantage in many instances.

When choosing a screen it should be remembered that while its reflective properties are paramount other important considerations, such as quality, cost and probable life, should receive careful attention.

TRANSLUCENT SCREENS. The translucent screens, as mentioned above, are screens which transmit the light from the projector to the audience. The projector stands behind the screen and projects through it. There are some advantages to this type of screen and several disadvantages. It is used ordinarily for the projection of opaque materials where it becomes advisable to have both the projector and the screen at the front of the room. Some have arranged a dark box for projection by covering the space between the screen and the projector with a dark cloth supported by two or three small rods. This keeps interfering light from the back of the screen and provides projection possibilities in a well-lighted room, which could not be accomplished otherwise. However, if it does become necessary to use such a screen temporarily it will be less expensive to construct the screen than to buy it. The chief requirements will be a frame of the proper size and enough architect's tracing cloth to cover that frame. The frame can be made by any manual training department or carpenter shop, and the cloth can be purchased at a book store or architect's supply house. A screen approximately 3x4 feet in size can be constructed at a total cost of $3.00 or $5.00, whereas the same screen of the special types prepared for the commercial field would cost $15.00.

When translucent screens are used, short focal length lenses are indicated, and this adds to the cost of equipment.

If a translucent screen is to be used regularly, a screen which has been built for the purpose should be purchased. The newer types of prepared translucent screen materials are superior to the tracing cloth which is recommended for temporary use.

AUDITORIUM SCREENS. The preceding discussions of screens have dealt entirely with screens for classroom use. The general principles of reflection should be applied in selecting a screen for a school auditorium. A much larger screen will be needed for satisfactory results in the auditorium and in most cases it will be desirable to purchase a screen which has been perforated for sound. The sound screen is very much the same as an ordinary screen except that it has been perforated with small holes through which

the sound from the loud speakers will pass when sound pictures are being projected. The perforated screens cost approximately the same as the ordinary screens and the small perforations will not affect the brightness of the picture to any great extent. These screens range in price from 40c to $1.25 per square foot, including a permanent mounting or shade roller. If the screen is to be extremely large, it will be better to have it mounted on a frame than on a roller. The rolled screens have a tendency to become frayed at the edges and wrinkled after some years of service.

TYPES OF SCREEN MOUNTINGS. Screens may be secured on tripods, in boxes on solid frames, or on covered or uncovered rollers to be suspended against the wall. A selection of the type of mounting should be determined by the situation in which the screen is to be used. If there is a railing above the blackboard in the classroom in which two small hooks or nails may be placed with ease, these will serve very well to suspend one of the screens mounted on an ordinary shade roller either covered or uncovered. However, it is necessary to have these nails or hooks placed in each room where the screen is to be used, so if it is not convenient to make such a provision, it would be better to purchase a screen on a tripod which can be adjusted to fit any situation. Any of the companies listed on page 205 will be pleased to send complete descriptive materials and prices concerning all types of screens. These screens will range in price from approximately $10.00 upward, depending upon the size of the screen, the quality of the screen surface, and the type of mounting selected.

Types of Sound Aids for Schools

The discussions which follow will give brief consideration to the various types of sound aids which are being used extensively among schools, omitting from this section those aids which are composed of synchronized sound and pictures—still or motion. The next section will discuss those aids which depend upon synchronization of sound and pictures for their effectiveness.

In general, sound aids have followed the development procedure of pictures. They have been invented and developed as an aid to industry, or as an entertainment feature. Later, when found to have educational value, they have been adapted to the instructional functions of the school. The phonograph record and the silent motion picture were developed for the entertainment of individuals and groups of individuals. The first attempts at synchronization included the basic principles of each. The radio program, which entertained the family at the fireside, was found to have unlimited possibilities in the educational field, and schools of today are making extensive use of the most effective radio programs.

The Phonograph Record

The desire to record sound so it might be reproduced is an ancient one. From Egypt comes the first corroborated account of vocal sounds issuing from a thing without life, more than 1,500 years before the beginning of the Christian era. An ancient Chinese book of 2,000 years ago contains a story of a curious box into which a Chinese prince was supposed to have spoken his message which he sent by a trusty messenger to his friend. When the friend opened the box, so the legend states, he could actually hear the words which had been spoken into it.

In more recent years, the history of science records scattered references to various attempts at recording and reproducing sound by mechanical means. The first authentic recording of the human voice was accomplished in 1857 by Leon Scott, a French scientist. The instrument was called the Scott Phonautograph. It traced a laterally undulating line on a cylinder which had been coated with lamp black. There was no provision for reproducing the sound.

In 1877, Thomas A. Edison invented his famous tinfoil machine. The record was a heavy metal cylinder, wrapped in a sheet of tinfoil. The recorder included a diaphragm and a stylus. Sound

vibrations caused the stylus to indent the tinfoil as the cylinder revolved past it. The reproducer was similar to the recorder, but much more sensitive. The results were poor and indistinct. The machine was cumbersome and impractical, but was of scientific interest and opened the door for further development of sound recording.

About 1882, Dr. Alexander Graham Bell, Sumner Tainter and Chicester A. Bell developed a process of recording on a wax cylinder. The recording was of the "hill and dale" type. They also developed a reproducing machine which became the early Gramophone of the American Gramophone Company.

Contemporaneously, Edison, working independently, developed a recorder for making cylindrical hill and dale records in wax, and a reproducer, which later became known as the Phonograph. As in the case of the Bell and Tainter machine, ear tubes were necessary for the use of the listener.

About the year 1887, Emile Berliner developed a disc record. This was of the lateral-cut type—recording lateral vibrations of the needle. The special screw feed mechanism which was required on the cylinder reproducing machines was no longer necessary. The Berliner process used a zinc plate or disc coated with a fine layer of acid-resisting material. The recording stylus produced a spiral groove, cutting through the acid-resistant coating. The disc was then subjected to an acid bath and the acid would eat in the zinc a groove of sufficient depth to vibrate the stylus of the reproducing machine. This zinc plate was then used as a "master" from which, by suitable processes, commercial records were made in a hard material. His reproducing machine was called the Gramophone and the reproduction was loud enough to eliminate the use of ear phones. Because of the action of the acid on the zinc, the scratch was almost sufficient to drown out the music.

Eldredge R. Johnson, who was operating a small machine shop in Camden, New Jersey, at this time, became interested in the Berliner machine. He refined and improved it. In 1896, he began the manufacture of the Gramophone for the Berliner Company. Johnson developed the spring motor—previous reproducing machines were operated by hand—and patented it in 1898. As a result of this, he was given reciprocal rights in the Berliner patents and worked in conjunction with the Berliner Company until 1901, when the Victor Talking Machine Company was founded. During the next twenty-four years, the talking machine evolved from the

first hand-driven model through the horn type operated by a spring motor to the cabinet model Victrola. In 1925 came the revolutionary Orthophonic Victrola and then the Electrola.

Prior to 1925, all recording was done by the acoustical method. Sound waves set up by the recording artist or artists caused a diaphragm to vibrate, which directly actuated the recording stylus. Artists worked under great handicaps in those days. Members of orchestras had to be bunched so closely together that they hardly had room to play. Some instruments had to be placed on high chairs or benches so that their tones could be directed toward the recording horns. The number of instruments which could be recorded at one time was definitely limited. Orchestras of twenty instruments presented tremendous problems, whereas today hundreds or thousands can be recorded without difficulty. Regular violins could not be used and it was necessary to resort to what was known as the Stroh violin. These Stroh violins were made with horns attached to them so they would throw the sound in one direction. The tone quality was necessarily poor. When orchestras were recording, violinists often had to play so close to other members of the orchestra that they would sometimes run their bows up the bell of a clarinet playing directly above them or into one of the other musicians' eyes. The confusion which often resulted can be imagined readily.

There are many tales of strange and interesting happenings in the studios of those days. Famous artists would often appear panic-stricken when placed in front of the recording horn. One star on his first recording got half way through his first song, broke down, picked up his hat and coat, ran out of the studio and left the orchestra sitting there. It was months before he could be coaxed into the studio again for a second attempt.

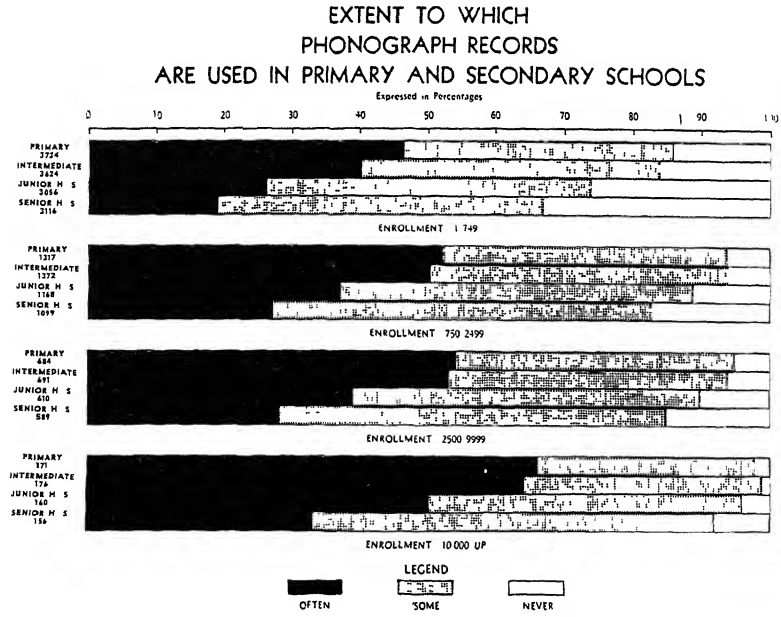
In 1925, electrical recording was introduced. Many of the former difficulties vanished but they were replaced by other more important problems. Much had to be learned about electrical recording. The microphone replaced the recording horn. The recording stylus was actuated by electrical impulses. High frequencies as well as low frequencies never before recorded were engraved on the surface of the wax. It was possible to record large symphony orchestras. No longer did the musicians have to be crowded together. They could play as they did on the concert stage.

Since 1925, the laboratories have worked continuously on improvements in electrical recording. As a result of these improvements, the present "Higher Fidelity" type of recording was devel-

oped. Properly reproduced, the Higher Fidelity record of today will give satisfactory reproduction of frequencies from approximately 30 to 8,500 cycles. Probable further improvements in recording and reproduction will increase this range to cover even higher frequencies.

Phonograph Records in Schools

So far as is known, the first phonograph record was used in a classroom for instructional purposes in 1909, in the public schools of Milwaukee, Wisconsin. It is a matter of record that the first important move toward utilization of the phonograph record among schools on a national scale was on April 1, 1911. At that time, the Victor Talking Machine Company took to Camden, New Jersey, an enterprising music supervisor from the Milwaukee City Schools. This enthusiastic young woman, Frances Elliott Clark, the first teacher to use phonograph records for instruction in music, believed that a major function of recorded music was to teach music and



Graph Courtesy Office of Education (1936 Survey)

music appreciation. She believed it should be taken into classrooms throughout the land, so children might learn to know and appreciate good music by hearing the finest compositions, reproduced from recordings of the world's greatest artists and musical groups. This belief has been substantiated by a steady increase in the use of recordings in schools. It has been attested further by the fact that phonograph records are used more extensively by schools today than are any of the other types of visual, sound or audio-visual aids to instruction.

The graph on page 12 shows the extent to which all types of audio-visual aids are used among junior high schools. The graph which appears on page 128 shows the extent to which phonograph records are used among all types of schools, from the primary through the secondary, and among schools of all sizes.

Teachers of music consider phonograph records to be indispensable classroom tools. Records are used to teach rhythm to pupils of all ages. Recordings of children's songs are used to teach those songs to individual pupils and to groups. Records which illustrate individual instruments of the orchestra serve well in teaching the sound of each. Other records teach the function of each in producing the stirring or soothing combinations of sounds resulting from group performance.

Records are used as patterns for vocal or instrumental performance, individually and in groups. Other records teach the types of music and bring to the classroom illustrations of music of all ages and nationalities. Records aid in studying and learning folk songs and folk dances of the world. Various applications of phonograph records in the teaching of music and music appreciation are almost unlimited. The study of music appreciation, including "Music Literature," "Knowing the Composer Through His Music," "Music History," etc., has come to be the central element in teaching music in the schools, especially in the higher grades and in the colleges.

The now familiar survey of music in colleges, and the resultant action of the Carnegie Foundation in donating to a goodly number of these upper schools a large and comprehensive library of records gave immediate proof of the findings of the Committee, viz: that appreciation through much hearing is the only way to reach the student body in a democratic presentation of music as a general culture subject open to all.

Many persons have the impression that phonograph records are effective only in teaching music and music appreciation. It is true that records are used more extensively for these purposes, but there are many other purposes for which they can be, and are being used effectively in classrooms and with school groups.

There are records which illustrate proper pronunciation and enunciation of foreign languages. Recorded speech aids in teaching the correct use of spoken English. Shorthand dictation exercises are used for speed practice. Rhythm records are used in penmanship and typewriting classes. Other rhythm records are used extensively by physical training instructors of large and small groups of all ages. Recorded music of various periods and nation-

Photo Courtesy RCA Mfg. Co., Inc.

Electric Phonograph for Classroom Use

alities is integrated with the study and teaching of literature, nature study, geography, history and other natural and social sciences.

A more recent development in phonograph records promises to make available for class use many of the best educational radio programs. It is difficult in many instances for schools to adjust their teaching schedules to utilize certain instructional radio programs to the best advantage. Recordings of these programs will make it possible for the classroom teacher to use the material when best suited to the teaching plans, and as often as may seem desirable.

The Radio Program

It is probable the use of radio in schools for instructional purposes is receiving more attention among schools and educational service agencies than any of the more recent sound aids to learning. The National Broadcasting Company, Columbia Broadcasting System, Office of Education and many smaller organizations are giving careful consideration to ways and means of utilizing radio to the greatest educational advantage. The problems are many. Some may require years to solve. The interesting phase of the situation is that broadcasting facilities, Government agencies and schools are working together, experimenting, planning and replanning, all for the ultimate benefit to Johnnies and Marys in the classroom and to older Johns and Marys who are no longer receiving formal instruction in the classroom.

One of the major problems is that of determining just which type of program is most effective in education. Education in the past remained rather harsh and sometimes distasteful, for "disciplinary" purposes. It is now very easy to turn the dial if the program has not sufficient appeal to the listener. Accordingly, it has been necessary to change the method of presentation—to catch and to hold the interest of the listener. Some programs have been too dull and others too entertaining to accomplish the desired result. The successful educational radio program of today is one which sets out to accomplish definite objectives and does so by following certain procedures. The bulletin, *Education by Radio*, presents a summary of "Guideposts for Producing Educational Programs," which should provide a clear impression of some of the problems of educational broadcasting.*

*Education by Radio, Vol. 7, No. 4, April, 1937: National Committee on Education by Radio, One Madison Avenue, New York City.

"Apropos Mr. Boutwell's claim for the mass appeal of educational programs, some readers may want to know the guideposts by which such programs are prepared. They are of two kinds: those which have to do with educational objectives, and those which are concerned exclusively with the problem of attracting and holding an audience.

"The following tentative educational guideposts have been suggested to writers connected with the Educational Radio Project:

1. Does the program have unity; that is, do the parts contribute to a central idea which, in turn, is a logical sector of a program series?

2. Is the subject matter selected educationally important? A good test of importance is whether or not the facts or anecdotes would be included in the curriculum of a progressive school system.

3. Will the program effectively induce a considerable proportion of listeners to explore the subject more completely by reading, by discussion, or other self-educative activity?

4. Is there a summary at the close to fix in the listener's mind the major points brought out by the script?

5. Is the selection and presentation of the material such that the voluntary interest of the 'students' (listeners) will be aroused?

"The guideposts for attracting and holding the attention of a radio audience are more numerous and perhaps less tentative. They include and supplement good practice in playwriting, which is almost a prerequisite for script-writing. They are as follows:

1. Listener attention should be caught in the first twenty seconds. Methods: novelty sound, theme music, interest-challenging statement, or provocative dialog.

2. The first minute of the script should arouse the curiosity of the listener in what is to follow.

3. Direct the program to the audience most likely to be listening on the station or stations being used at the time allotted. Are they women, children, men tired from a day's work, city people, country people? Keep in mind what a majority of listeners are likely to be doing while you are seeking their attention. Try to fit your program to what you think their mental state is at the moment.

4. Limitations of listeners both in terms of vocabulary and experience should be kept in mind. Don't ask listeners to make mental expeditions too far beyond the range of their power.

5. The subject of the broadcast must be potentially interesting to a majority or a reasonably large proportion of listeners reachable at the time and through the outlets available.

6. The presentation should include listener participation, if it is nothing more than keeping time to music, laughter, using paper and pencil, or even more important, an emotional response, a desire to "do something about it."

7. Visualize scenes and people before beginning action; that is, "set the stage."

8. Each voice or sound should be clearly established; that is, listeners should not be left wondering who a speaker is or what a sound is. All future behavior of a character should be motivated beforehand.

9. Each line of dialog should be as short as possible and to the point, without hurting characterization or dramatization.

10. The script should "flow." Even more essential than on the stage or in a moving picture, because of the limited time and holding power, the lines of a radio script should advance the plot or the subject matter steadily toward the climax.

11. Variety is essential. No actor or group of actors should be asked to carry a scene longer than interest in a particular situation can be maintained—about two minutes.

12. The script should continually remind listeners of others present in the scene, even if they are not speaking.

13. Sounds and action should be properly prepared for in advance; that is, if the Indians are coming, anticipation of the sound of hoof beats must be built up in advance.

14. Characters should speak in character; residents of a particular place should speak like residents of that place.

15. If an address to which mail is to be sent is used, it should be repeated at last three times. The same holds true for the name of the school, agency, or company. Any offer used at the close of a broadcast should be prepared for at the opening.

16. Directions for the production director and music director should be ample and clear."

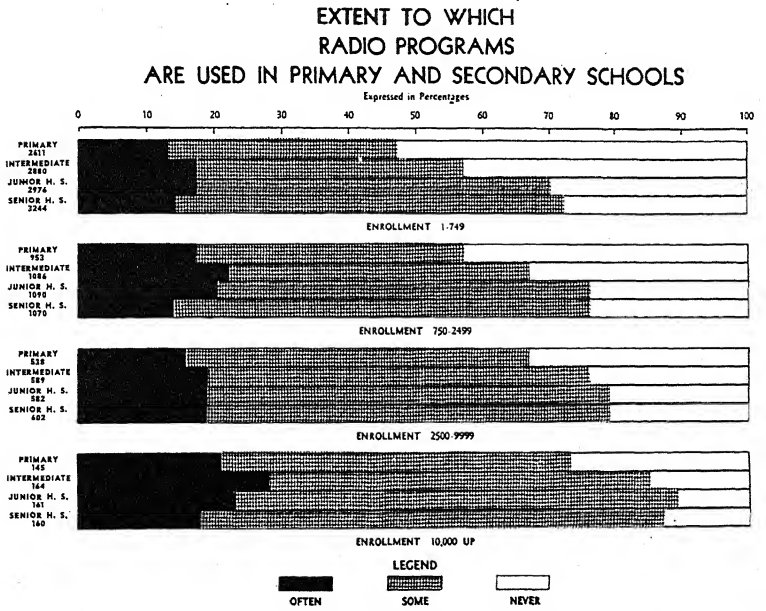
The problem of utilization of radio programs in the school is another which puzzles many who desire to offer every educational advantage within the schools. It is stated earlier in the discussion of motion pictures that the presentation of a reel or two of film is not teaching and may be an utter waste of time. Similarly, the mere listening to a radio program—the best on the air—may or may not have instructional value, largely depending upon the way in which the program is used. It is possible to secure advance information concerning the most prominent series of educational programs. These advance announcements or bulletins usually contain sufficient information to guide the teacher in preparing classes for intelligent reception.

Some programs, such as the NBC "Music Appreciation Hour," CBS "School of the Air," health lectures, correct speech demonstrations and the like are suitable for a major part or all of the student body. Other programs in science, geography, history, etc., should be utilized by those groups which will be able to relate the radio lesson to the scheduled classroom procedure. Otherwise much time may be applied at a disadvantage or entirely wasted.

The varying curricula of schools present a problem to the educational broadcaster and to the teacher who would make effective use of the best educational radio programs. It is impossible to arrange educational broadcasts to fit the schedules of all schools. Similarly, it is impossible for all schools to standardize instruction to the point where a radio subject or series—except for certain general programs for the entire student body—can be utilized in all schools at a given hour, day or week. These problems may be solved by the recording of the most effective radio programs, as discussed later. Another aid to the solution of some of the problems is suggested in the discussion of centralized sound distribution equipment.

The paramount advantage of the educational radio program is that it can be used with equal effectiveness by the smallest rural school in the land; by the school in the town of moderate size; or by the largest city school or school system. The rural school without electricity can secure at low cost a battery receiving set which will provide satisfactory reception year after year. The larger school may use individual receiving sets or centralized sound equipment to reach any or all rooms and the school auditorium with clear reception. In any case, the programs which have cost thousands of dollars to produce are available without charge and the equipment may be secured and maintained at negligible cost per

pupil. In all cases, the selection of equipment should be based on the quality of performance rather than on price. Frequently the saving of a few dollars in original cost of equipment may prove to be the least profitable investment. Equipment of poor quality, rendering unsatisfactory service, will do more to deaden a powerful instructional tool than will any other factor.



Graph Courtesy Office of Education (1936 *Survey*)

The production of radio programs for broadcasts and mock radio programs for use within the school or other group is becoming one of the most effective methods of applying radio technique to instruction in music, speech, dramatics, history, geography, science, and many other subjects. A script exchange offered by the Office of Education* provides a wealth of effective instructional material for use in schools, CCC camps, and other educational groups. Many broadcasting stations offer their facilities to schools at little or no cost for the presentation of such programs, if well

*Federal Radio Project, U. S. Office of Education, Department of the Interior, Washington, D. C.

done. Many larger schools and school systems are making regular use of such facilities. The motivating power of these local productions is an immeasurable force, resulting in voluntary research, reading and study which could be obtained in no other way.

The future of the radio in education seems limited only by the ability of teachers, supervisors and school executives to plan their educational procedure so they may utilize the effective programs at their disposal. Past and current activities of both private and governmental broadcasting facilities establish the fact that those agencies will provide to the best of their ability the educational programs which will be most effective in instruction. This is further attested by the widespread activities of city, state and university broadcasting stations which are offering excellent educational programs to the schools in the areas which they serve.

Radio Recordings

The preceding discussion of the radio program suggested one of the difficulties encountered in applying radio programs to instructional procedure. Many times the radio program is not on the air when it would be most convenient for the class or section which should secure the greatest benefit from the program. This means that it is necessary to disrupt other class schedules and plans or miss the program entirely. The latter is the easy solution, and one that is used too frequently.

A more logical solution of the problem, which is receiving the attention of broadcasting facilities and schools, is that of recording the radio programs for use over and over again with different classes or sections and for use at the time when the instructional material fits the teaching schedule. These recordings of radio programs are known as transcriptions. This means simply that the program has been recorded for reproduction.

A plan to make available many excellent recordings of radio programs is being put into operation by at least two of the large broadcasting companies and by the Federal Radio Project, U. S. Office of Education. This plan provides for the preparation of transcriptions or radio recordings of leading educational broadcasts for use among schools. These radio recordings, many of which will be available early in the fall of 1939, provide that important and frequently missing link between the broadcasting studio and the classroom. It is likely the radio recordings will be offered

for sale at a reasonable price and, as with motion picture films, will be offered for temporary school use at low cost through state and city service bureaus. This will make it possible to fit desirable material into the teaching schedule and will eliminate the need for adjusting the daily routine to fit broadcast schedules.

It is not anticipated that this new radio recording service will cover all programs of merit. Such programs as the Damrosch "Music Appreciation Hour" of the National Broadcasting Company and Columbia's "School of the Air" fit the teaching schedule and should be heard as they are presented. Also, important international news broadcasts and special events should be heard while on the air. On the other hand, there are many fine programs in the fields of science, dramatics, literature, history, health, geography, etc., which will be more convenient to use as recordings.

Transcription play-back equipment, now available or under production, will make it possible to use these fine teaching materials —scientific aids to instruction—when and as needed. This equipment ranges in price from $110 to $135 complete. Also, specific attachments are available for use with radio receiving sets, public address equipment, and sound motion picture projectors.

An explanation of the difference between phonograph records and transcriptions (radio recordings) seems to be in order at this point. The standard phonograph record is recorded on a recording wax which revolves at the rate of 78 revolutions per minute. As the wax revolves at this rate, the sound is registered in undulating lateral waves in spiral grooves of which there are approximately 100 to the inch. The average ten-inch phonograph record can accommodate a maximum of approximately three minutes and fifteen seconds of recording on one side. A twelve-inch record can be used for a recording period of approximately five minutes. The process of making a transcription record is approximately the same, except that the transcription wax revolves at the rate of 33⅓ revolutions per minute, making it possible to record for fifteen minutes on one side of a sixteen-inch disc. In either case, pressings are made after due processing and the resulting records, or transcriptions, must be played on instruments which revolve the record or transcription at the speed at which it was recorded. In other words, the phonograph which reproduces the phonograph record must revolve the record at the rate of 78 revolutions per minute while the transcription reproducing equipment revolves at the rate of 33⅓ revolutions per minute.

Each type of recording has certain advantages. The transcription record makes it possible to record and reproduce for a full fifteen minutes without interruption to change or turn the record. The maximum recording on one side of a twelve-inch phonograph recording recorded at standard phonograph speed is approximately five minutes. This means that in recording and reproducing a fifteen-minute program of phonograph records it will require two sides of one record and one side of the second record. On the other hand, the phonograph records may be used on any standard phonograph, whereas the transcriptions must be used on special equipment which revolves the record at slower speed. It is not known which type of record will be used most extensively for the purpose of recording radio programs and it is possible some programs may be made available on both types. In either case, a school will be able to purchase for permanent use the best of recorded educational programs at nominal cost per program. The advantages of this will be recognized immediately.

Instantaneous Recording Equipment

The usual phonograph records or transcriptions are made by recording on wax. The wax is then processed to provide a master, from which, after further processing, a matrix is made. The matrix is used to press the records which are reproduced on Victrolas or other record-playing equipment. This procedure requires several hours of careful labor of skilled technicians, and the result is the fine phonograph record which may be purchased almost anywhere. The process is moderately expensive, so is not used generally except when many copies of the recording are desired.

The instantaneous recorder, on the other hand, may be used to record speech, music, or any other type of audible sound on a "blank" recording disc and reproduce that recording as soon as completed, with no processing required. Acetate recording discs range in price from 25c upward, and may be used to record several minutes of individual or group performance. The records may be used many times and additional copies may be prepared either by re-recording (dubbing) or by using processes similar to those applied to wax recordings.

These recorders are available in three general types, to accommodate almost any situation. There are small portable recorders which can be carried from one room or building to another as

required. These small instruments are usually equipped to record on 6-, 8-, 10-, or 12-inch discs, at 78 revolutions per minute. The resulting records may be played on the recorder or on any standard Victrola. A larger semi-portable or console type recorder is built to accommodate all sizes of records up to 16-inch transcription discs, and will record at either 78 or 33⅓ revolutions per minute. The principal advantage of the slower speed of operation is that it permits recording about two and one-half times as long as the recording time at 78 r.p.m. on a recording disc of any given size. The chief limitation is that 33⅓ r.p.m. recordings can not be reproduced on standard phonograph equipment which revolves at 78 r.p.m.

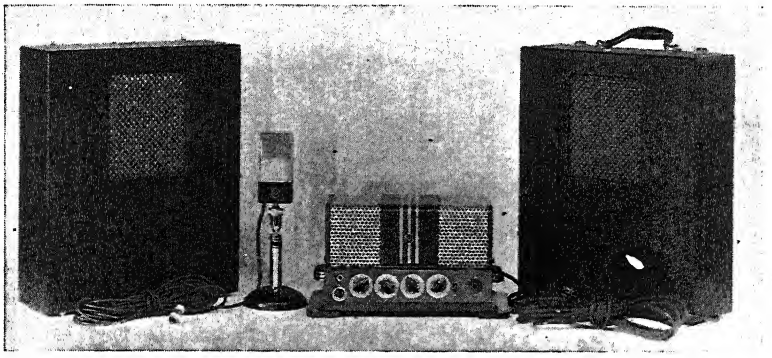


Photo Courtesy RCA Manufacturing Co., Inc.

A Portable Public Address Unit for Auditorium Use

The third general type of instantaneous disc recorder is the recording attachment which is used with a school sound system or with public address equipment. This equipment may be used to record any sound which is being distributed over the sound system, or to record any type of individual or group performance. In addition, it may be used to reproduce, through the sound system, any type of disc recording—phonograph record or transcription.

The possible and practical uses of instantaneous recording equipment are almost unlimited, and new uses are being discovered daily. It is used in all grades and with adults to detect and correct speech irregularities or difficulties. Such recordings permit the pupil to hear himself as others hear him—and he knows the

recording doesn't lie! They also permit the pupil to measure his own progress by comparing early recordings with later ones.

Teachers of speech, dramatics, languages, and other subjects involving the use of the voice have long needed some objective measure or means of making a comparison of progress. Usually, progress or lack of it can be detected during a semester or a year, but frequently the change is so gradual that it is difficult to determine its extent after or during any given period of instruction. Accordingly, teachers of those subjects are finding it exceedingly important to make recordings of speech or other individual performance at the beginning of a course of training so these recordings may be compared with later recordings by the same pupils after they have received a part or all of the scheduled training. There is no other way to secure an objective measure of progress.

Teachers of music, vocal or instrumental, are faced with much the same problems and will find a good recorder to be a first-class assistant. There are many times when music teachers would welcome an opportunity to let Johnny or Mary, or an entire group of pupils, know how he, she, or they really sounded in performance. The recorder provides an accurate sound photograph which will be helpful to both pupil and teacher. Furthermore, it will eliminate the personal element and errors of human judgment.

Individual pupils or groups of pupils who perform in radio programs are required to perform with split-second accuracy. Again, a good recorder will be invaluable in rehearsals. Sometimes these recordings may be used for repeat performances, over the school sound system or over another radio broadcasting station.

A rifle team of the University of Kansas may compete in a match with a team of the University of Maine, and neither team leave its campus. Each team will shoot a series of targets and the scores are compared by mail. Similarly, a school glee club, band, orchestra, chorus, quartet, or individual musician may enter into a contest against the performance of any other group or individual. by using recordings. This procedure has been used effectively in debate work for many years and is now becoming common in musical performances.

The most modern recording instruments are simple to operate, reliable in performance, and require very little attention to keep them in first-class condition. Any teacher can soon learn to make excellent recordings. One necessary precautionary measure is to place the recorder in a room where it is protected from extraneous

sounds or vibration, as a good recorder will record all sound which reaches the microphone.

Photo Courtesy RCA Manufacturing Co., Inc.

Recording to Detect and Correct Speech Irregularities

Sound Amplification or Re-Enforcing

The problem of providing sufficient sound to reach all corners of an auditorium or other space with clearness has confronted individuals and groups since the time when the Roman Senators were

elevated to their lofty positions largely because of the stentorian qualities of their voices. It is no longer necessary for the individual or group to endure unusual stress and strain in order to reach the ears of the audience, regardless of the size of that audience. Simply operated sound-amplifying equipment makes it possible for the person or group to perform at normal speech or sound levels and have that performance amplified to reach any audience.

The required equipment may range from a small, portable amplifying or public address system costing less than $100 to an elaborate arrangement of amplification and speakers which will accommodate any audience or type of program. A portable public address unit capable of re-enforcing sound to accommodate an audience of 3000 to 4000 persons may be purchased for less than $300. Equipment of this type may be used in the school auditorium, in the gymnasium, on the athletic field, or on the school playground with equally satisfactory results. One will recognize at once the value of being able to amplify sound in any or all of these situations.

The majority of the portable and stationary sound amplifying equipments are so arranged that they may be used to reproduce and re-enforce music or speech which has been recorded on phonograph records. A simple record playing device, costing less than $20, may be attached to the sound system for this purpose. Similarly, it is possible to amplify radio reception with the same type of equipment if the receiving set does not have sufficient volume to accommodate the space or group where the program is utilized.

The selection of sound re-enforcing equipment for any given situation should be based upon the recommendations of a sound engineer who is familiar with the requirements. Frequently savings may be effected or more satisfactory equipment may be secured by observing this suggestion. The principal manufacturers of sound equipment are prepared to provide such advice without cost or other obligation to the school. In one situation a school which made use of this service was able to secure a thoroughly satisfactory sound re-enforcing unit at approximately $100.00 less than the estimated cost based on catalog information. There are occasions, also, when one type of microphone may provide much more satisfactory service than another, and the sound engineer is able to recommend the best for any given situation.

Centralized School Sound Systems

Another comparatively recent development in the sound field is a combination of radio reception, sound reproduction, amplifica-

tion and distribution equipment, sometimes known as a public address system. This equipment makes it possible to convey any type of sound to any or all rooms within a school building or group of school buildings. The usual arrangement of such a system is to provide for a central control apparatus in or near the office of the school principal, making it possible for him or for one of his assistants to send a radio program, music or speech from a phonograph record, announcements, lectures, debates, plays, or any other type of program to any room, series of rooms, or to the entire building.

The cross-section illustration (page 145) shows how the central control unit is connected to various rooms. Another illustration (page 144) shows the detailed arrangement of the control mechanism which makes it possible for the operator to distribute programs as desired. For example, it is possible to send to the classes in geography a program in which those groups would be interested. At the same time, the classes in history or general science might receive an entirely different program. It is possible, also, that the principal might desire to make certain announcements to still other groups without interrupting those who are receiving the geography, history, or general science programs. The central control mechanism makes it possible to accomplish all this with ease, thus providing an adaptability which could not be accomplished as readily in any other way. A good school sound system lightens the principal's administrative duties, increases efficiency of teaching, and enriches the school curriculum to benefit both pupils and teachers.

A complete school sound system includes the following:

1. A centrally controlled cabinet, usually located in or near the principal's office, containing:
   (a) Two or three connections to each classroom.
   (b) One or two radio receivers.
   (c) A phonograph turn-table.
   (d) A microphone input connection.
   (e) Connection for a recording attachment.
   (f) A monitor speaker.
   (g) Appropriate amplifiers and tubes.
2. Speakers in all classrooms.
3. Special speakers in the auditorium, gymnasium, cafeteria, and on the athletic field.
4. One or two microphones and microphone locations throughout the building:

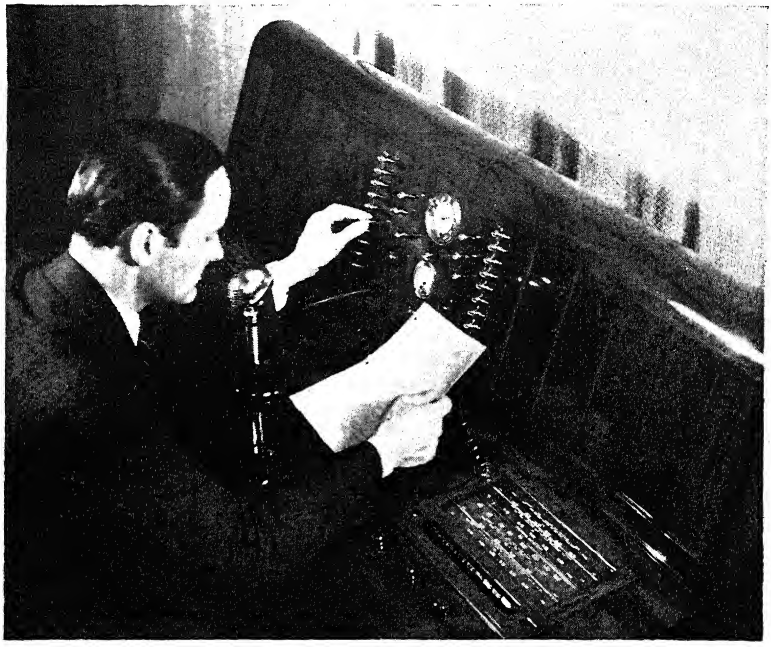


Photo Courtesy RCA Manufacturing Co., Inc.

Control Cabinet of a School Sound System to Accommodate 20-120 Rooms

(a) In the principal's office.
(b) In the auditorium.
(c) In the music room.
(d) In the dramatics department.
(e) In the public speaking department.
(f) In the gymnasium.
(g) On the athletic field.

The following outline of common uses of a school sound system should indicate the possible values to be derived from such equipment in any school situation.

I. General Administrative Uses:

1. Announcements (to any or all classrooms).
   (a) Daily spoken bulletins to teachers and pupils. (More effective than in written form.)
   (b) To call faculty, departmental, class, or club meetings.

(c) To check and encourage attendance and punctuality among pupils.
(d) Electric chimes can be used in place of jangling bells, to indicate opening and closing of usual class periods.

2. Communication:
   (a) Direct communication with teachers or pupils in any classroom, without interfering with classroom procedure by calling on a telephone.

3. Emergency situations:
   (a) Principal may locate a teacher or a student quickly in case of an emergency of any kind.
   (b) In case of fire, pupils may be directed along routes which avoid danger. Fire drills and other safety precautions may be directed to any or all parts of the building.

4. Discipline:
   (a) Absence of the teacher from the classroom does not leave the pupils without control.
   (b) Natural voice amplification in the auditorium lessens restlessness and avoids disciplinary problems.

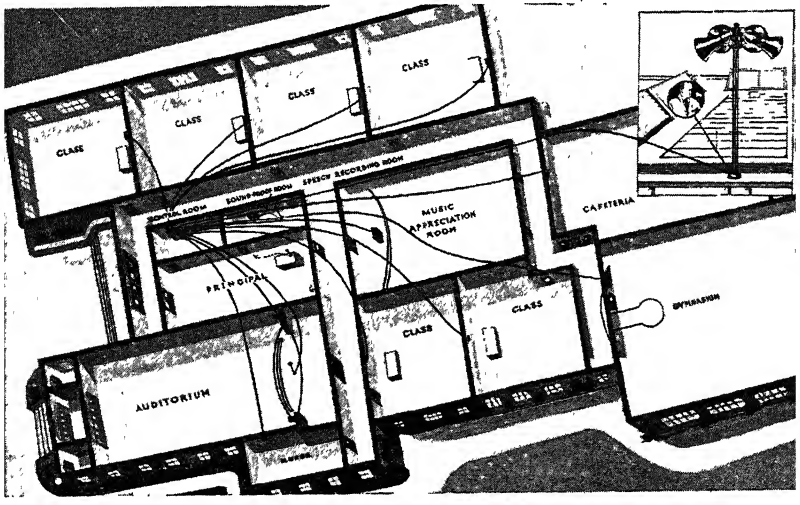


Photo Courtesy RCA Manufacturing Co., Inc.

Diagram of a Model School Sound System

5. Increased efficiency:
   (a) Eliminates the necessity of frequent special assemblies.
   (b) In instances where the school auditorium is too small to accommodate the programs, they may be sent from the auditorium to overflow students in classrooms or study halls.
6. Student training:
   (a) Student council discussions of important problems may be relayed to the entire student body.
   (b) The reading of the Scriptures or other opening exercises may be conducted over the sound system.
   (c) Presentations of radio guild productions; plays; musical programs; voice training; public speaking; microphone techniques—all may be accomplished by students.
   (d) Students develop poise by presenting special reports to one or more classes in history, English, literature, science, etc.
   (e) Members and leaders of clubs, classes, and other school groups use the system for appropriate announcements to the student body.
7. Controlled testing:
   (a) Psychologists may give controlled tests to similar groups in unison, thus avoiding variation in the testing procedure which might effect the validity of the results.
   (b) Teachers may give the same tests to two or more sections simultaneously, with assurance that the timing factor is controlled.

II. Classroom Instruction:

1. Radio programs:
   (a) National network programs in music and music appreciation, dramatics, science, health, history, geography, and other subjects.
   (b) International and domestic broadcasts, covering current events, news bulletins, important speeches of national leaders, etc.
   (c) Foreign broadcasts in native languages, for students of those languages.
   (d) Programs of local and educational broadcasting stations, planned to enrich the curriculum.

Photo Courtesy RCA Manufacturing Co., Inc.

Table-type Centralized Sound System for 10-40 Rooms

(e) Radio recordings of important broadcasts repeated as needed in the teaching schedule.

2. Special subjects:
   (a) Teaching of art and music appreciation may reach any part or all of the student body as desired.
   (b) Health, hygiene, and other special subjects may be presented to selected groups including any desired number of classes.

III. General School Activities:

1. Recorded or radio programs may be presented in the auditorium when school band or orchestra is not available.
2. Musical programs by the glee clubs, band, orchestra, or chorus may be sent to any or all rooms or to outdoor groups.
3. Recorded music may be played for dancing or dancing class instruction in the gymnasium, for the changing of classes.

or as background music during plays or other special programs, indoors or outside.

4. Broadcasts of significant public events, inaugurations, etc., may be presented before special assemblies.
5. Recorded sound effects may be used for presentation of plays, radio guild productions, etc., or sound effects may be produced away from stage.

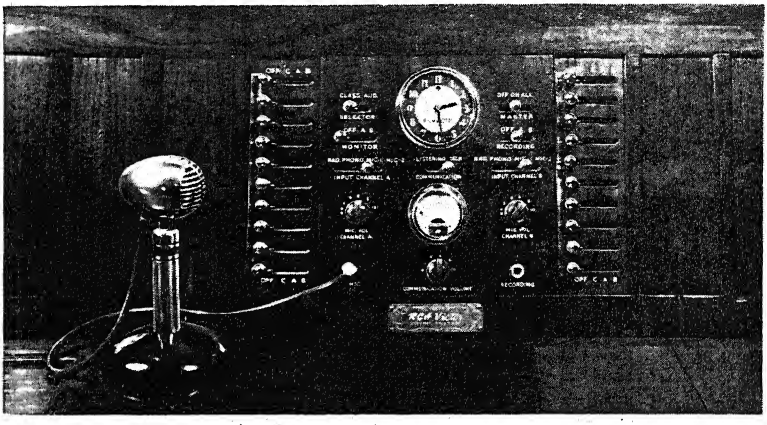


Photo Courtesy RCA Manufacturing Co., Inc.

Control Panel of a Centralized School Sound System.

IV. Extracurricular Activities:

1. Sports announcing and commentary at outdoor games, track meets, football games, etc.
2. Sound amplification for special exercises on school grounds, such as May Day, Memorial Day, and dedications of new buildings.
3. Commentary on indoor sports, such as basketball games, gym meets, indoor track, swimming, etc.
4. Presentation of Christmas carols and other community programs to large indoor and outdoor audiences.
5. Recording of special programs by use of the recording attachment. Such recordings provide an excellent record for future reference.

This list could be expanded indefinitely and, as stated above, new and important uses will be discovered from day to day as the

school sound system becomes familiar to principal, teachers, and pupils. In some situations, the centralized sound systems of two or more schools are interconnected by telephone lines so a program originating at one school may be sent to all rooms of that school and of the other schools connected with it.

Again, it is suggested that those interested in the installation of this type of equipment should request the assistance of qualified sound engineers who are available for such service. It is impractical to suggest a possible price range, as very few situations have identical requirements, but quotations for any given situation may be obtained quickly from any of the leading manufacturers of school sound systems. Their advertisements appear in the principal school journals.

Types of Audio-Visual Aids to Instruction

It should be noted that the preceding discussion of aids to teaching was placed in two general groups—types of visual aids, and types of sound aids. In the former, consideration was given to pictorial or graphic aids of all types. In the latter group, consideration was given to sound aids which depend upon sound for their value and have no direct connection with the preceding visual aids. It is true that some of the visual aids might be used in conjunction with sound aids with thoroughly desirable results. Such combinations of aids will depend almost entirely upon the ability of the teacher to recognize the elements in each which should be combined for effective results. The discussions which follow will concern those combinations of pictures and sound which depend upon positive sychronization for their effectiveness.

The Sound Filmslide

The sound filmslide might be termed a combination of the ordinary filmslide and of the phonograph record or transcription, which were discussed earlier. The sound filmslide is composed of two major parts. One is the series of still pictures printed on 35-mm. motion picture positive for projection by use of a filmslide projector. Such a strip of film may include any desired number of "frames" or individual pictures. The other part is the recorded sound which illustrates or explains the picture series. This combination of sound and picture is projected and reproduced by means of a simple instrument, one section of which projects the picture to a screen before a group and the other reproduces and amplifies the sound so it may be heard clearly by all members of that group.

The sound filmslide, known in the industrial field as the sound strip film or filmstrip, has been developed by industry for sales and educational purposes. A central agency may prepare and record a discussion of new models, new sales plans, the story of a product, or any one of hundreds of other topics and distribute the resulting sound filmstrip to hundreds or thousands of branch offices or salesmen for use simultaneously. It is really a convenient means of communication when either a long or short story must be told effectively. The sound filmslide is used by all types of industries largely within the organization, but is used in many instances to tell the story of products to the public. Several of the Government agencies are

using the sound filmslide to disseminate information concerning the functions and achievements of those agencies. In other cases they are using sound filmslides for instructional purposes.

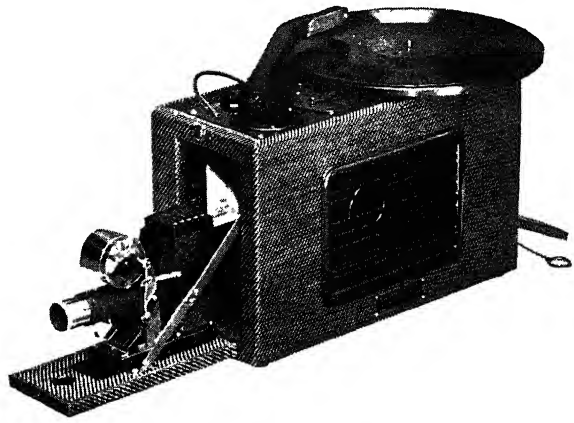


Photo Courtesy The Magnavox Co., Inc.

A Portable Sound Filmslide Projector

The sound filmslide is not used among schools to any great extent. It is doubtful that this situation will exist for long, inasmuch as various organizations are giving consideration to the sound filmslide for use in classrooms. The *Committee on Scientific Aids to Learning is directing the preparation of a series of sound filmslides of teaching units, to be used experimentally among the schools of New York City. Certainly the recorded lectures of acknowledged specialists, illustrated by appropriate still pictures, will be of greater value in the classroom than the reading of articles prepared by the same or other specialists on similar topics.

Frequently, the story which is to be told is one with which the teacher is not thoroughly informed. A good sound filmslide illustrating and telling the story of cotton, for example, will give the pupil in fifteen minutes a much better impression of cotton and the ramifications of the industry than the same student could hope to obtain through the reading of many pages or by listening to lengthy discussions by someone who is not thoroughly familiar with the subject.

*Committee on Scientific Aids to Learning, 41 East 42nd St., New York City.

The situation which affects the use of sound filmslides among schools is similar to that which affected the use of motion pictures for educational purposes a few years ago. Producers of sound filmslides state that it will not be profitable to produce subjects for use among schools until the schools have equipment on which to use those subjects. Schools do not expect to purchase equipment until there is a reasonable supply of subjects available, or reasonable assurance that such subjects will be made available as required after the equipment is secured. It is probable this deadlock will be broken as in the case of the motion picture—by some enterprising commercial organization which recognizes the potential market among schools for this type of material. Also, as in the case of the motion picture, it will be necessary for the producer or producers to work closely with the schools for the purpose of determining the exact teaching requirements.

At the outset, the chief advantage of the sound filmslide will be the very low cost at which it can be produced and distributed. When sound filmslide subjects are available for educational use, it is probable the filmstrip and accompanying record or transcription may be purchased as a unit at a cost of a few dollars. The projection and reproducing equipments are now available on the market at prices which range from $50 to $100, or more. The cost will be considerably less than the cost of sound motion pictures and projection equipment, and in many instances it is probable the projected series of still pictures will be as effective as would be the same material in motion picture form.

Those who may desire to prepare their own sound filmslides for regular or experimental use may do so by preparing a series of still pictures on a filmslide and recording the explanatory material on an instantaneous recorder. The record, if recorded at 78 r.p.m., may be reproduced either on a portable recorder or any standard phonograph, as the pictures are being projected with a filmslide projector. It is not necessary that both instruments be combined, as shown in the illustration, although the combination instrument is convenient to use.

The Sound Motion Picture

The battle rages on! Embattled on the one side, we find those who claim that sound detracts from the instructional value of the motion picture instead of increasing its teaching value. Entrenched on the other, we find those who claim that recent developments in

educational sound films have relegated the silent film to obsolescence. But there are forming larger forces than those of either of the belligerent factions who believe that both the silent and the sound film have certain definite valuable functions to perform—that each has its place and there is a place for each. The author chooses to cast his lot with this larger group, not for safety, but because of an honest conviction that neither the sound nor the silent film, alone, can accommodate the requirements of schools as adequately as both.

The survey* of visual aids and visual instruction equipment conducted by the Office of Education in 1936 indicated that the ratio of silent to sound projectors in use among schools was approximately 12 to 1. This ratio is being modified by an increasing tendency on the part of schools to purchase projectors that will show both silent and sound films. The buying of straight silent projectors has not ceased; in fact, it is reported to show a slight increase from year to year. The increase in the number of sound projectors bought recently by schools is relatively far greater, however. The majority of the sound projectors purchased by schools are of the 16-mm. type, although some schools are installing 35-mm. sound equipment, or both, in order that the best of standard theatrical productions may be used for both educational and recreational purposes. Practically all 16-mm. sound projectors are designed to accommodate either sound or silent films and this versatile equipment seems to be the wisest investment for the school which desires to make the most effective use of educational motion pictures.

One of the greatest factors which has retarded the more widespread use of sound motion picture equipment among schools has been the lack of a sufficient quantity and variety of good educational sound film. This situation is being corrected rather rapidly and it should not be long until the supply will be sufficient to meet the requirements of the average school. Several important developments have contributed to this essential change.

There is an increasing tendency on the part of city and state visual instruction centers to purchase outright just as many worthwhile sound films as their budgets will permit. Thus, in Chicago, since 1937, the county schools bought 30 and the city schools 152 prints of Erpi Classroom Films, as well as several hundred reels from other sources. This trend toward expansion of sound film resources is reflected in the lending libraries. Thus, in three years, the Bell & Howell Library, which caters mainly to school service,

*National Visual Education Directory; American Council on Education, Washington, D. C., 1936.

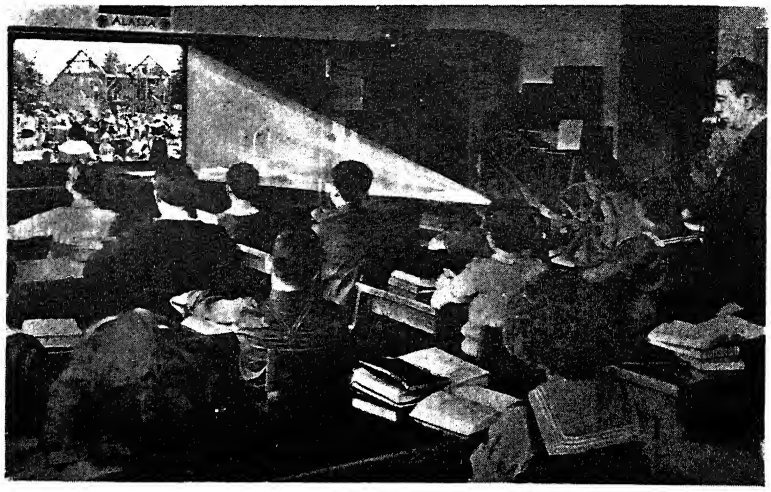


Photo Courtesy Bell & Howell

Motion Pictures in Classroom Use

increased its listings of sound rental films from less than 100 to over 1,000 titles, while at the same time reducing its rental rates and sale prices on many subjects.

This has encouraged production of classroom films by independents, often with the collaboration of local educational authorities. Many examples might be cited, among them "The Mail" and "Airliner" (T. A. I. E. Productions), "Elephants" and "Congo Curiosities" (Paul Hoefler), "Under the South Seas" (Arthur C. Pillsbury), "Earth and Its Seasons" and "Mysteries of Water" (Knowledge Builders), and the "World Parade" and "News Parade" series (Castle). It has also encouraged the distribution of a fine series of British teaching films by Gutlohn, Bell & Howell, Lenauer Films, and others.

The rapid growth of the market for sound films usable in the schoolroom has attracted the interest of theatrical producers. Thus, Pathe has made available such pictures as "Old Faithful Speaks," giving the actual sounds as well as sights of Yellowstone National Park, "Craters of the Moon," and "City of Proud Memories." Columbia released a series of ten "Voice of Experience" radio-theater reels. Paramount offered a series of "exploitation shorts" based on current features such as "The Plainsman," "Maid of Salem" and

others. These excellent one and two-reel educational releases were edited by Mr. Ralph Jester, with the collaboration of active visual instructionists of southern California. For a year, several of these were available to schools on an outright purchase basis and over a hundred prints of "Spirit of the Plains" were placed with visual instruction centers. The films were then withdrawn, presumably in the interest of making uniform the policy of the producer toward school film distribution. It is anticipated that sale or long-term lease of this series will soon be resumed.

Several major Hollywood producers have released their features and short subjects for non-theatrical distribution, through such national distributors as Bell & Howell, Films, Inc., Gutlohn, and Kodascope. These producers include Universal, R. K. O., Paramount, Grand National, and Gaumont-British, with isolated films from some others. In most cases, the 16-mm. distributors are charged with the responsibility for avoiding conflict with theatrical interests, but in some instances the major producer exercises direct regulation of the uses to which 16-mm. prints of his films may be put. Thus one major producer requires that his local theatrical exchange manager give prior approval to any school or other "location" before his films can be shown there. Another producer proposes elaborate regulations to prohibit film showings except between 9 and 3, to teachers and pupils only, and with 80% of the school's "playing time" reserved to that producer's pictures, as a condition for renting any of his releases.

The problem of avoiding competition with nearby motion picture theaters should not be insurmountable, if educators approach the use of films in the school from a teaching rather than purely show-business viewpoint. A year after its theatrical release the average film has very little further box-office value, and it could well be made available henceforth for school use, if suitable for educational purposes. There is little chance of competition with the theater, particularly since the pictures most desirable for school use seldom rank highest in box-office returns, according to Dr. William Lewin's report at the 1938 N. E. A. meeting.

Increasing recognition is being given the use of the feature film in the school for other than purely entertainment purposes. One film rental library selects and groups its feature films for their historical, ethnographic, or human relations interest, for occupational or literary background, and for motion picture appreciation study. Self-censorship is rigorously practiced by the serious 16-mm. film library that caters to school business, and objectionable sec-

tions of otherwise good films are deleted from prints intended for school and home use.

The availability of 16-mm. sound films for school auditorium use permits better control of photoplay appreciation study, now widely prevalent in junior and senior high schools. A large percentage of pupils see a recommended film, under identical school conditions, and standards of taste and technique may be objectively discussed without any chance of a local theater man complaining that the school was "knocking" his shows. At the same time, the encouragement of attendance of worthwhile pictures at nearby theaters can actually be intensified, as a result of the study of selected films, of slightly older vintage, but of more or less permanent worth, in the school auditorium. The relationship of school and theater in this connection is parallel to that of school and periodical publisher. The English classes' study and analysis of selected short stories, poems, and novels certainly does not hurt the magazine publisher—on the contrary, it is his sole guarantee of future market for good writing. Forward-looking motion picture people are begining to take the same attitude.

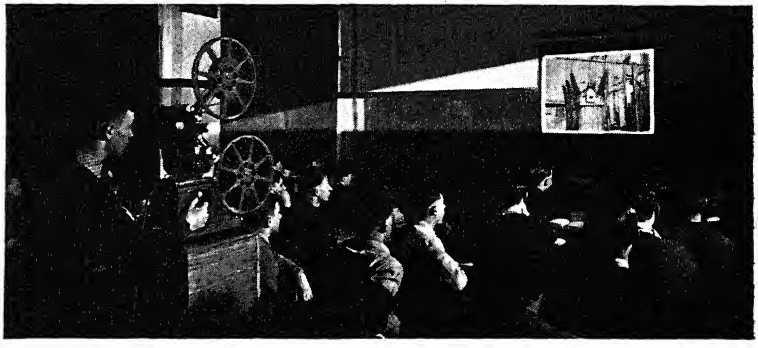


Photo Courtesy Ampro Corp.

Student Operating Motion Picture Projector in Class

Interesting "Discussion Outlines" are available for use with feature films of solid educational worth. Discussion is begun perhaps weeks in advance of the playdate, many subject-matter groups at various age levels engage in this advance consideration of questions to be raised in the scheduled film. The picture itself furnishes a common emotional experience for all the pupils and teachers of

the entire school. After it has been viewed, projects and school journeys are planned and further discussion is held, with the teacher guiding and adapting whatever discussion serves subject-matter needs. This method helps break down rigid walls between subject-matter fields, for a pupil may have been called upon to think about and discuss a given film from half-a-dozen or more distinct angles, not the least important of which is the acquisition of a good emotional attitude toward the problems of conduct or "human relations," raised in every well-made motion picture. This *emotional* contribution of the motion picture is an utterly unique gift placed at the service of the school. It is still so new that no very clear evaluation of its possibilities has been attempted, yet this phase is coming in for ever more attention in current visual instruction meetings.

The "human relations" angle is being studied thoroughly by a group of progressive educators, headed by Dr. Alice V. Keliher. A project that is being financed jointly by Rockefeller funds and by the Hays Organization, provides for the cutting of theatrical features into short subjects, posing but not solving problems in human relations. These short films are then discussed freely in class, the utmost freedom of self-expression by the students being encouraged. So fruitful has been this discussion that it has been made a regular radio broadcast, one of the very few unrehearsed programs to go out over the air. The use of these films is at present confined strictly to "human relations" groups in twenty selected experimental schools, but it is hoped that these restrictions will be modified, on these excellent pictures, and on the earlier "Secrets of Success" series, of similar type, edited by Dr. Howard LeSeurd.

Another effort to overcome the major producers' fear of possible exhibitor protest against non-theatrical film circulation in any form and at any age, is the formation of The Association of School Film Libraries, Inc. Its organizational work financed by the American Council on Education, this new corporation grew out of successive conferences of visual-aid administrators at Washington, Chicago, and Atlantic City. Its president is Dr. J. C. Wardlaw, of the University System of Georgia, its director, Fanning Hearon, formerly Director, Division of Motion Pictures, U. S. Department of the Interior. It is hoped that this organization, free from any "commercial" interests, will be able to mass its purchasing power and ideological pressure to obtain the release at low prices of certain films not now available.

Among the films sought by this organization, is a series of several hundred evaluated very thoroughly by panels of educators

organized by Dr. Mark May, of Yale, during the summer of 1937, in cooperation with the Hays Organization. The conditions of distribution remain for the individual owners of rights to the approved films to determine.

The problem of quantity—whether there is enough film to justify the purchase of a 16-mm. sound projector—has been overcome. One library alone offers a sufficiently large selection of titles to permit the running of a feature and three shorts every week for five years without "repeats." Most of this film is selected originally on the basis of school fitness, since the schools at present constitute the largest group outlet for this type of service. Quality of available material is not uniformly high, but improvement is to be noted, and there is already discernible a trend to drop out the less desirable listings. This improvement in quality may be expected to increase as both supply and demand grow.

A number of schools and systems, including leaders in visual education, such as Pittsburgh, are using sound films to meet other than teaching situations. In one case, undesirable school surroundings are minimized by motion pictures shown at lunch recess, the School Board paying for all rentals. In another case, auditorium noon-day movies take the strain off an overcrowded lunchroom. Sometimes such films are free, sometimes subject to a small admission charge to cover rentals. Sometimes they are just clean entertainment, sometimes reels selected for additional use the same day for classroom work.

The C. C. C. represents an educational endeavor in which motion pictures are particularly effective aids. The entertainment problem represents an important side of the big cultural job confronting Camp Commanders and Educational Advisers. The size and restricted character of this audience has resulted in letting down many bars to the circulation of 16-mm. films in the camps, and has resulted in the purchase of hundreds of projectors. This work borders on the extensive Adult Education program fostered by other government agencies, in which the motion picture is also playing an increasing role.

TYPES OF SOUND PRODUCTIONS. The earlier educational sound films were silent films accompanied by sound which was recorded on a disc. This was known as the "Vitaphone process" and it has been superseded in both the theatrical and educational fields by sound-on-film recording. In the case of the sound-on-film productions, the sound is recorded along the edge of the film, using a nar-

row strip of space between the picture and the line of sprocket holes on one side of the film. This type of sound recording has developed to the point where it is extremely accurate in reproduction. The new ultra-violet ray recording process developed by RCA has increased the range of accurate recording and reproduction to the point where it is now possible to record and reproduce almost any sound which can be detected by the human ear.

Similarly, the first 16-mm. synchronized sound subjects were of the sound-on-disc type; not entirely satisfactory because of the difficulty of obtaining absolute synchronization of sound and picture. It was believed by many that it would be impossible to produce a satisfactory recording of sound on 16-mm. film. There were two problems to be solved. One was the problem of securing sufficient horizontal space to permit the use of a sound track and the other was the problem of reducing the sound to the point where the normal recording on 1000 feet of 35-mm. sound track could be included in the 400 feet length of one reel of 16-mm. film. These problems have not been solved to the point where 16-mm. recording and reproduction of sound has a range as wide as that accomplished with 35-mm. On the other hand, the developments have reached the point where 16-mm. sound film recording and reproduction cover the principal range of normal sounds. Accordingly, the 16-mm. sound-on-film equipment has replaced the sound-on-disc and its reproducing equipment.

The projection equipment for the use of 16-mm. sound films is necessarily more expensive than silent projection equipment. The projectors range in price from $275 to $1,500, including projector, amplifier, speaker, and other accessory equipment required for operation. The less expensive equipments are those which are designed primarily for use in classrooms while the best projectors, naturally selling at higher prices, may be used in auditoriums and in other large spaces where it is necessary to project a large picture much further than the ordinary length of a classroom. All of the usual 16-mm. projectors are portable, but any equipment which is expected to give the best service should not be moved or shipped any more than is absolutely necessary, inasmuch as there is always danger of damage in handling.

The 16-mm. sound projectors mentioned above are available with illumination units which range in power from 750 watt incandescent lamps to 1200 watt incandescent lamps. In addition, some of the more recent projectors offered to the school and in-

dustrial market are equipped to use either the high-powered incandescent lamps or low intensity arc lamps. It is believed by some that these more powerful projectors may be used to a considerable extent in the future by small theaters which do not operate continuously and must keep their operating cost at a minimum in order to realize a profit.

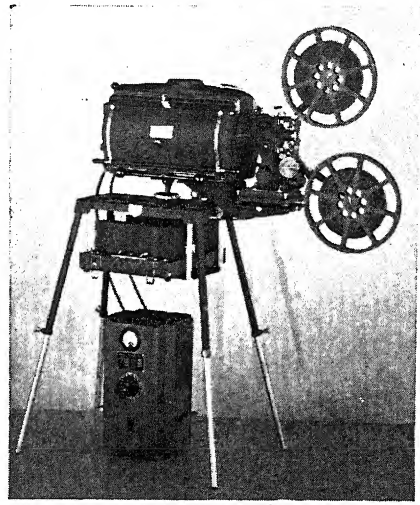


Photo Courtesy Ampro Corp.

16-mm Motion Picture Projector with Arc Lamp (for large auditorium)

The selection of a 16-mm. sound motion picture projector for any given situation should be based upon the planned use of the equipment. If the projector is to be used in classrooms only, any of the standard portable units will be satisfactory. These same projectors will provide adequate picture quality and sound amplification for a small auditorium. In unusual situations where the projection distance is of reasonable length but the auditorium is rather large, adequate sound may be secured by using added amplification and speakers. The representatives of those who manufacture this equipment are very glad to recommend the type of projector best suited to any given situation and their recommendations should be considered carefully.

There will be some additional complications in the manipulation of the sound equipment as compared with the projector for silent

films. However, the sound projectors have been simplified in operation to the point where any person who is at all mechanically inclined will be able to operate the equipment under ordinary conditions. The earlier projectors were built to operate on alternating current only, but many of the more recently produced equipments operate on either alternating or direct current.

The majority of the current models of 16-mm. sound motion picture projectors, in addition to reproducing pictures and sound well, also make provision for the use of a microphone to permit speech input. Provision is made, also, for attaching a record player to provide background music or to amplify the reproduction of recorded music and speech. It is possible to arrange several uses for the one basic projector unit, but usually desirable to secure separate public address and record reproducing equipment if these

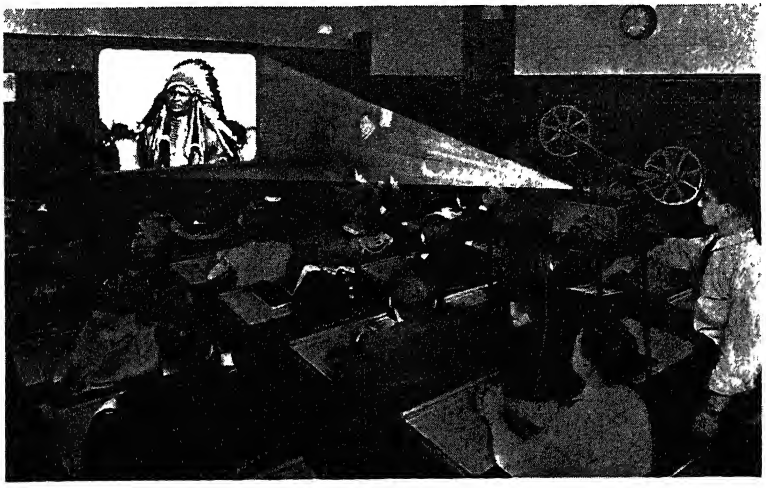


Photo Courtesy Bell & Howell

16-mm Sound Motion Picture Projector Used in High School

uses are frequent. Separate units are more versatile and provide multiple service which cannot be obtained with a single equipment.

The recent books by Colonel Devereaux,* Dr. Brunstetter,**

*Devereaux, F. L., *The Educational Talking Picture*, University of Chicago Press, 1933.

**Brunstetter, M. R., *How to Use the Educational Sound Film*, University of Chicago Press, 1936.

and Dr. Arnspiger*** are so complete in their treatment of sound motion pictures for educational purposes that it would be inadvisable to attempt any additional suggestions. Those who are planning to make use of sound film in connection with their work should purchase and read carefully each of these books, all of which are available from the University of Chicago Press. Each contains many suggestions which will be a distinct aid to the teacher, supervisor, or administrator in the school or school system using or planning to use sound pictures.

Television

Interest in television, thoroughout the world, is great. Early in 1937 a fellow passenger on a transcontinental train was somewhat perplexed that he had been unable to secure a television receiver for use in his home. It was his prophecy that by June of 1937, television receivers would be obtainable as readily as radio receiving sets. He seemed to feel there was some sort of a conspiracy among manufacturers to hold off the sale of television receivers until every effort had been made to dispose of radio receiving sets on hand.

His thinking was filled with fallacies. In the first place, no first rate manufacturer of radio receiving sets has had a large stock on hand. The majority of manufacturers regulate their production to supply the demand. Secondly, it is now evident that the leading manufacturers of radio equipment are the ones best qualified to manufacture and sell television receivers. And, thirdly, television transmission and reception has been in the experimental stage until May 1939, when a regular telecasting service was started by the National Broadcasting Company, coincidental with the opening of the New York World's Fair.

Although television broadcasts are now an established service in the New York area, effective transmission is limited to forty or fifty miles. Until this range is extended or until sufficient auxiliary and relay transmitters are installed, the possible uses of television for educational purposes are limited to the New York metropolitan area and to other similar areas where television transmitters are now under construction. Accordingly the use of television for instructional purposes would not seem to be an educational possibility except in those areas. The future of television as a teaching tool is promising, but not subject to reliable estimate at present.

***Arnspiger, V. M., *Sound Pictures as Teaching Aids*, Bureau of Publications, Teachers College, Columbia University, 1933.

In the meantime, those in educational work who may be hesitating to secure radio or motion picture equipment for school use for fear of obsolescence due to rapid television developments, may dismiss those fears and proceed with reasonable assurance that any up-to-date equipment installed this year or next, or during the next several years, will be extremely useful for many years to come. The development of the motion picture and its subsequent use among schools has not caused a decrease in the use of still pictures in education. The development of the sound motion picture has not caused a decrease in the use of strictly educational silent films among schools. The rapidly increasing use of radio in education has not caused a decrease in the use of phonograph records. On the contrary, each new development seems to validate the potential values of earlier developments and cause those older types of audio-visual aids to become more important in the classroom. Similarly, it is expected that the development of television, however rapid or delayed it may be, will but serve to increase the educational importance and use of all types of audio-visual aids among schools.

Facsimile

Facsimile is not a new art, but recent developments have brought it into prominence as a potential teaching tool of considerable promise. One of the first patents was recorded in 1842 by Alexander Bain. However, it is new as far as the general public is concerned, and as far as what we mean today when we mention fascimile.

Facsimile is the replica, or the reproduction, of an original. A facsimile reproduction of a legal document is legal—a signed check transmitted by facsimile is legal. Facsimile was first used in a slightly different form commercially, known as radio photo. Then it progressed into the wire photo service—the pictures were distributed by telephone methods. Those systems are basically facsimile systems, but the equipment was designed for further reproduction. The facsimile of today is a broadcast receiver and is not designed for reproduction. It is a final picture or product. It is a very interesting device; and like a great many other scientific devices, the actual value will depend upon the ingenuity of the various groups using it.

Technically, the basic system consists of sending and receiving instruments. The sending equipment utilizes the photo-electric eye to scan in an orderly fashion all the line elements of a page of ma-

terial placed in the scanning machine. As the scanner passes over a given point at a given time it receives more or less reflected light, depending on whether the subject matter is black or shades of gray or white. It transfers these light variations into electrical impulses which are amplified by conventional amplifiers and passed to a transmitter similar to those used for transmission of voice or music.

At the receiving point, some form of printing mechanism is necessary which screens the receiving paper in exact juxtaposition with the sending point. This reconstructs a large number of dots or lines across the page, in exactly the same relative position and in the same density; in a sense half-toning or screening the picture. One of the major practical difficulties is the fact that whereas these commercial units have skilled engineers operating the receivers, the home receiver has to work automatically without any processing on the part of the home owner. This must be simplified and made as fool-proof as possible. There have been important strides in this during the past year.

The sending equipment, called a scanner, is being sold to

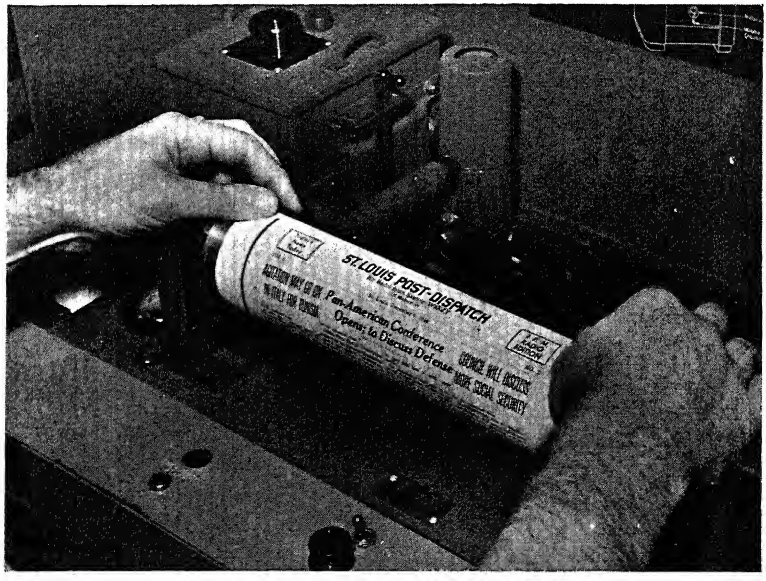


Photo Courtesy RCA Manufacturing Co., Inc.

Placing Printed Material in a Facsimile Scanner

Photo Courtesy RCA Manufacturing Co., Inc.

A Facsimile Receiver in Operation

various broadcasting stations which are experimenting with it at present. The Radio Commission to date has issued only experimental authorizations. This cannot be used for commercial purposes. The majority of these are newspaper owned.

The equipment can be used on any wave length transmitter in broadcasting. That automatically places it into two wave lengths; the normal broadcasting band, and the experimental band—ultra-high frequency. Technically, the major difference in those two is that facsimile broadcasters are allowed by the Commission to broadcast on the normal broadcast band only in the early morning hours, while all ultra-high frequency stations are allowed to broadcast facsimile at any time of the day or night. Early morning hours are effective over a much greater distance.

The standard bands would make facsimile more suitable to rural coverage. Ultra-high frequency, or u.h.f., as it is usually designated, would be used primarily for urban coverage. The regulations governing an experimental broadcasting station on standard bands require the station to buy the scanner and a minimum of fifty

receivers which are distributed among the homes and in public places. On u.h.f. there are no minimum requirements on the number of receivers, but a minimum of 10 to 20 is necessary for worthwhile results. The broadcasting stations themselves do not know how facsimile will be used eventually, and neither do the newspapers. Many feel that it will be confined to a bulletin or flash type of news giving a much more highly edited copy than a conventional lengthy story that appears in the newspaper.

Some editors are looking forward toward embarking on a new type of news coverage which the liberal thinkers in the newspaper industry are advocating. It would be more of a classified arrangement of the news in briefer, more highly edited form. Just how this tool can be used in education is a question. We should look at it from a fundamental viewpoint rather than say, "I'll send so and so lessons or such and such forms to my schools." Fundamentally, this is a printed form of record communication. The combination of sight (visual) and sound media ought to form a highly effective medium for use in educational work as well as in normal broadcasting work.

Some of the stations feel that simultaneous transmission of a program on their normal sound panel could be worked out in connection with a cooking school. As the young lady describes procedure and mentions ingredients, she could refer to the facsimile for the recipe. Fashion talks could be given in the same way. There are numerous other possibilities of that type which might be applied to educational work.

The paper on which the image is reproduced is eight and one-half inches wide, coming out at the rate of three feet per hour. It is technically possible to roll the paper out much faster than that, but the cost makes it entirely out of the question at present.

The scanner, which was mentioned, costs approximately $3,000. Standard band receivers are $260.00 each; the u.h.f., $240.00 each. In the future, the two bands may be combined in one receiver to make it more saleable—and this may be a sound and facsimile receiver. The upkeep is nominal. The principal depreciation would be obsolescence.

The first experiment with the use of facsimile in a school system was conducted by the Radio Department of the Cleveland City Schools in February and March of 1939. Five schools were equipped with receivers and the scanner operated through the u.h.f. transmitter of the Board of Education. The Superintendent's Bulletin was sent to each school, by facsimile, rather than through the

mail. News summaries were broadcast, as well as the high school newspaper. Instructional guides were sent to the various schools and were received clearly. The operation was highly satisfactory and created considerable interest among those who saw the demonstrations.

It is much too early to make any predictions concerning the probable future use of facsimile among schools. The manufacturers have developed a new means of communication, will further perfect it, and its future in schools will be determined by the ability of school executives and teachers to employ this new device effectively.

Organizing the Audio-Visual Service

Recent surveys of audio-visual aids in use among schools have produced evidence of an interesting trend. It has been the common practice among schools and school systems to centralize the visual instruction service—to make some person or committee responsible for organizing the plans for procuring and using appropriate visual aids to instruction. These individuals and groups have been given authority to coordinate the requirements of various teachers, departments and schools, often including the training of teachers in the use of visual aids.

It has required several years of blundering and sometimes painful experience for schools and school systems to realize that visual instruction plans, to be effective, must take into consideration the curricula of the schools concerned, the general plans of the various departments, and the specific plans and needs of individual teachers. Otherwise, as actually happens when visual aids are used haphazardly, there will be waste of time, money and teaching effort. All three are too limited to be applied in any but the most effective manner. But the lesson has been learned and the majority of the schools have delegated responsibility, providing relief from other duties to permit required attention to be given to visual instruction planning. Those schools which have not done so will find it both economical and efficient to follow the trend.

This advance in the administration of the visual instruction program among schools has laid a good foundation for the intelligent use and administration of sound and audio-visual aids to learning. Schools are purchasing equipment and supplies to meet the requirements of a planned instructional program. Also, it seems a general practice to utilize the organized visual instruction department or program—an experienced person or group—for the coordination of the general audio-visual program. Perhaps the natural link between sound and silent educational films has brought this about, but many visual instruction departments among schools have been extended to include direction of the use of radio programs, sound amplifying equipment, sound recording equipment, phonograph records, and the equipment for reproducing and distributing sound. Again, the principal advantage is that of coordinating plans to avoid waste of time, money and teaching effort.

General Problems of the School Unit

The problems of organizing and utilizing the audio-visual program are many, but each may be solved if given appropriate consideration. One of the major problems of many schools is that of securing adequate funds with which to inaugurate and maintain an audio-visual program. If this problem is considered on a par with the problem of securing funds for salaries, buildings, coal, library supplies or textbooks, it becomes easier to solve. It is true that there are boards of education and other controlling elements in the community which are sometimes difficult to convince that a school or school system should have modern equipment in order to do its work well and achieve the most effective results. But the fallacy of the overworked statement to that effect is that it is sometimes easier to convince boards of education, parent-teacher associations and other groups of the desirability of an adequate audio-visual program than it is to convince school administrators and teachers. Why? Perhaps those on the outside of the school system are not so thoroughly grounded in tradition and procedure that they cannot recognize the potential values of desirable change.

The best argument for securing needed funds to conduct an adequate audio-visual program is to make a small start, demonstrate effectiveness, and use the results as a basis for extending the service to other classes or school units. There is no school which cannot make some use of school journeys, exhibits, specimens, photographs, phonograph records, stereographs and other simple but effective teaching tools. The major requirement is a bit of teacher energy and enthusiasm applied intelligently, as many good aids are available at little or no cost. The expansion of this small start to include filmslides, glass slides, motion pictures, radio, centralized sound equipment and other effective aids will become a logical procedure, fostered by favorable results from the use of the simpler and less expensive aids.

Another major problem is that of training teachers to use teaching aids properly. There are certain audio-visual aids, such as motion picture programs of general interest, radio programs of world importance, materials for teaching safety and health, and aids for the teaching of music appreciation which may be applied to an entire school or school system with highly favorable results. On the other hand, the more extensive and usually more effective use of audio-visual aids is in the classroom—teaching aids which have been selected to increase the rate of learning certain subjects

or to broaden knowledge of those subjects. This means that teachers in service as well as those in training must receive advice and actual instruction in applying aids to the teaching of the subjects assigned to them.

Teachers in training in the majority of the teacher-training institutions are given opportunities to learn the techniques of using visual aids. Some are given training in the use of phonograph records, radio and audio-visual aids. More than 200 institutions are offering visual instruction courses regularly and many others demonstrate the use of audio-visual aids to the teaching of science, history, music, speech, language, geography, vocational guidance, health, physical training, commercial and other subjects. Some institutions require evidence of such training before graduation. The proper procedure for assuring appropriate use of effective teaching tools among schools is to train teachers as a requisite for entering this important field.

The problem of training teachers in service is more difficult to solve. Some of the larger school systems have approached a solution by organizing training courses which are attended by employed teachers. Extension courses are available from the leading universities and teachers' colleges. Visual instruction directors organize special institutes and demonstrations of the use of audio-visual aids. Books and pamphlets in the audio-visual field are made available for reference use. District, county, state and national meetings of teachers usually include demonstrations of teaching aids and the larger group meetings include exhibits of the most recent developments. Summer training courses in the use of radio are offered by many institutions. All these activities aid the teacher in service but there remains a need for more extensive group demonstrations and more intensive training of the individual teacher. This, in turn, further justifies the desirability of delegating the responsibility for the audio-visual program of the school or school system to one or more persons who will make certain that teachers receive the necessary assistance and training.

Using Audio-Visual Aids in the Classroom

The possible applications of audio-visual aids to classroom procedure are unlimited. This does not mean that every school or room should have an elaborate set of equipment, but that no teacher should fail to make appropriate use of certain readily accessible audio-visual aids. The following discussion will mention a few of

the more prominent aids but, of course, there are many variations of these and many additional materials which may be utilized with highly favorable results.

IN THE PRIMARY GRADES. The sand table, paper cut-outs, models, pictures, charts, phonograph records, and some forms of projected pictures are especially suitable for use in the primary grades. Number combinations and elementary reading material can be presented in slide form with effective results. A great motivating force in the elementary classroom is that of permitting the pupils to make pictorial materials to be projected or to be placed on display. The recent development of the non-inflammable "Lumarith" as a substitute for glass in making slides provides a type of material for use in the lower grades which eliminates the danger of broken glass. It is easy and entirely safe for small pupils to make their own slides and project them on the screen.

The phonograph record may be used to good advantage from the lowest grades through college and for adult education. There are many recorded songs for children, instrumental studies, rhythm records, singing games, folk dances, etc., which are unusually effective in the primary grades. Some of the recently recorded fables and readings will help in the interpretation of stories for children. The recorded story of "Little Black Sambo," with appropriate sound effects, is unusually interesting to children, and almost as interesting to adults.

In many instances it has been found advisable to use motion pictures in the lower grades. Motion pictures of children's stories serve well to inaugurate projects of various kinds and to give a clearer understanding of the stories themselves. Some teachers have used the "Chronicles of America Photoplays" in grades below the level of those who are just beginning the study of history. They have found that these dramatized events in American history are highly intelligible even to first, second, and third grade pupils. The new children's films produced by Erpi Classroom Films and Eastman Teaching Films are used extensively and effectively in the lower grades.

There has been some feeling that the projection of motion pictures before very small children might cause a strain upon the eyesight which would be harmful. Tests have been conducted to determine the effect or fatigue of watching motion pictures, and the majority of those who have reported state that if the pictures are projected properly there is no measurable eye strain. Of course a poorly projected picture will strain the eyes of either child or adult.

IN THE INTERMEDIATE GRADES. There is a much wider range of materials from which to select for the intermediate grades. Here again one of the first objectives of the visual instruction program should be that of pupil participation, either directly or by assisting with the preparation of certain materials. Visual aids may be used in elementary composition, both oral and written, to provide subject matter around which to work. There is a great stimulating effect from pictures particularly in arousing interest in subjects somewhat removed from the usual contacts of the pupil.

The pupils in the intermediate grades can prepare much of the material which is needed to illustrate day by day work in geography, history, and other subjects. They have just reached the collecting age and can be of great assistance to the school in the collection and preparation of materials for the school museum. In addition to materials prepared locally, there are many excellent pictures, stereographs, glass slides, filmstrips, and motion pictures which are especially adapted to the intermediate grades. One of the most noteworthy developments of recent years is the special series of highly illustrated texts prepared by the Keystone View Company* and another set of material which is especially helpful has been prepared recently by Photographic History Service.**

There are various types of sound and audio-visual aids which are particularly effective in the intermediate grades, such as the more advanced types of phonograph records; particularly those designed for use in early music instruction, or the teaching of music appreciation. Recorded works of literature and musical recordings which are correlated with the study of literature, history, geography, and nature study begin doing their most effective work in the intermediate grades. There is a tendency toward instruction in speech in those grades, making it desirable to use speech recording equipment for the purpose of encouraging and measuring improvement. There are many radio programs which are suitable for intermediate groups.

IN THE SECONDARY SCHOOLS. Probably the greatest quantity of prepared visual aids are available for the use of the secondary schools. There are hundreds of reels of motion pictures, thousands of glass slides, hundreds of filmstrips, prepared sets of mounted pictures, stereographs, and exhibits. Certainly there are few high school teachers who cannot locate much good material to be used for the improvement of instruction.

*Keystone View Company, Meadville, Pennsylvania.
**Photographic History Service, 5127 Franklin Ave., Hollywood, California.

In addition to fitting pupil-made and commercially prepared visual aids into the work of the high school, the science, geography, and history teachers have many opportunities to prepare their own materials, some of which are more helpful than much of the service available in prepared form. Maps can be traced on glass slides and projected for teaching and checking purposes. A map projected to the blackboard is clear to everyone in the classroom and may be used as the basis for fixing locations. When it has served its purpose, the only erasure necessary is to turn out the light. If it should be necessary to identify certain things on the map with chalk, no harm is done to the projected map.

Outline slides of insects, flowers, plants, animals, life cycles, and of almost any other class or group of subjects may be prepared on glass slides. Typewritten information, questions, etc., may be placed on cellophane slides for projection. These simply constructed aids may be used for identification, study or testing purposes, thus providing the advantages of concentrated attention and convenience.

High schools are finding it more and more advisable to depend upon visual aids for the purpose of developing special projects. Frequently the work of the school is photographed with a still camera and transferred to glass slides for projection, or is recorded on motion picture film. Athletic events, commencement exercises, school plays, pageants, and numerous other activities of the usual school may be recorded and preserved as a running story or history of the institution. These devices aid in bringing the school closer to the community, which is always a desirable move.

In the high school, and in many cases in the junior high school, it is advisable to offer courses in photography so the pupils may have an opportunity to become acquainted with the manipulation of a camera. Perhaps there is no single instrument which will return as much genuine pleasure to the owner as a good camera. Many persons who own cameras have no good idea as to how they should be used and waste much film either through improper exposure or improper selection of the subject itself. A course in the fundamentals of photography would be of inestimable value to those persons as well as to all who may be interested in making the best use of leisure time. A group of students in a class in photography could handle the major part of the necessary photographic work of the school and could do much to provide suitable illustrations for various school publications. Furthermore, a group of this kind—with proper direction—can make many useful glass slides, filmstrips, and possibly motion pictures for teaching various subjects.

The teaching of high school groups offers a fine opportunity to make use of all types of sound and audio-visual aids. The sound motion picture has been found to be especially desirable when used properly in high schools. There are literally dozens of excellent radio programs designed for high school instruction. The band, orchestra, and musical appreciation programs are utilized by high schools more than by any other grades in the educational span. Sound recording equipment is used in speech and music classes and frequently for the purpose of recording radio programs which are to be used over and over again in certain classes or sections. This same equipment is used to record school productions and a very recent development is the use of recording equipment to make transcriptions of debates which are sent from one school to another and are used in opposition to a debating team of another institution. Many high school groups are preparing radio scripts and producing radio programs which are broadcast over local stations. The best of these are used by the large broadcasting networks. Again, recording equipment is helpful in checking the preparation of the program itself.

Practically all school buildings which have been constructed during the past few years have included provision for centralized sound equipment. This is particularly true of high school buildings, but the same procedure is being followed among elementary schools. The many advantages of such equipment are obvious. Perhaps the greatest advantage is the saving of administrative time when it is necessary to convey messages from the office of the principal to teachers or students in various classrooms. The centralized sound equipment offers another advantage in providing an opportunity for high school students to obtain actual microphone experience. This is particularly valuable at a time when speech is so important in everyday affairs and the microphone is almost an essential piece of equipment for speaking to groups of any size. The same equipment may be used for distribution of recorded programs, either phonograph records or transcriptions. The development of music appreciation is made much easier by the use of modern phonograph records and centralized sound equipment which permits the use of the recorded music in any number of selected rooms at the same time. This avoids special assemblies, which in turn avoids waste of time and increases the effectiveness of instruction.

IN COLLEGES AND UNIVERSITIES. Recent trends in the foremost colleges and universities of the United States indicate that there is a tendency to deviate considerably from the time-honored lecture

path. Many instructors depend upon slides, films, and other aids to assist them in creating and maintaining interest in their subjects as well as in explaining that which they desire to have the students grasp. Some of the most successful teachers in our outstanding universities use the blackboard, the chart, the exhibit, the slide and the motion picture regularly in connection with their work. One very popular teacher of sociology uses such a simple article as a wasp's nest to illustrate many of the principles of social organization and cooperation. All such devices have a tendency to develop strong interest and create indelible impressions.

The majority of the motion picture subjects which were available eight or ten years ago were designed primarily for the junior and senior high school level. More recently many subjects

Photo Courtesy Dr. J. B. MacHarg

A College Lecture Room Equipped with Globes, Maps, Projectors and Screens

have been prepared especially for use in college classes, including a liberal supply of technical subjects for advanced and graduate groups. The excellent series of instructional sound films now being produced in cooperation with the University of Chicago is but one example of the trend toward a more effective teaching of college subjects. Lecturers who come before college groups are finding illustrative materials of various kinds to be extremely helpful. The majority of those traveling lecturers who meet college audiences regularly are using objective illustrations. The lecture which is advertised as being "illustrated" will draw two or three times as great an audience as another lecture of similar quality and importance without the added interest of projected pictures.

Although it is likely the leading high schools are using sound and audio-visual aids more extensively than the average college, it is also likely that the average college is using these aids in a greater variety of ways than the high school. One of the most recent developments among colleges, which is a rather direct result of earlier music appreciation work among elementary schools and later among high schools, is the more or less widespread attention that is being given to music appreciation. Some colleges have established music libraries which contain books and other publications, but the more important equipment is a very complete collection of phonograph records. These music libraries include in their equipment record-playing devices and listening rooms where students may go to hear the finest of recorded music. In some instances, record albums are available for loan to students very much as books, pamphlets, etc., are provided. This rapidly developing interest in good music among college students has caused the Carnegie Foundation to establish a fund to be used in providing music libraries and facilities for those schools which demonstrate sufficient interest by first building their own libraries of recorded music and providing opportunities for student participation. The interesting phase of this new development is that it is being used by law students, engineers, medical students and those in advanced college courses almost as much as it is used by students in the fine arts departments.

The need for sound-distribution equipment is not as great in colleges as in high schools, although some colleges are finding the equipment to be extremely useful. Sound amplification equipment is almost a necessity in the college auditorium and equipment for recording sound is becoming standard in speech and music departments as well as in orientation and guidance programs. Training schools attached to teacher-training institutions naturally make use of all types of audio-visual aids, thus providing the appropriate training for the prospective teacher who will be expected to use these aids as soon as she is employed in the classroom of a modern school.

Applying Audio-Visual Aids to Special Fields

It is unnecessary to discuss at length the possible adaptation of different types of visual aids to instruction in the subjects of the school curriculum. Those who are teaching in various fields will recognize at once those materials which seem to fit best in their specific situations. There is a wealth of material for use in teaching social sciences, including geography, history, and civics. Certainly

there is no more effective way to give an impression of life in another part of the world than to bring into the classroom exhibits, specimens, models, photographs, slides, motion pictures, and recorded music of the places and peoples of that section. There are many excellent motion pictures of habits and customs among peoples in all parts of the world.

In the linguistic studies, pictures are being used extensively as a foundation for language training. The student in German can learn to recognize, pronounce, and define the word, "dachshund," but a simple picture of one of these elongated dogs would form a mental association which would be permanent. Many language teachers are finding it much easier to teach fundamental vocabularies by using both individual and group pictures which are identified by the use of appropriate words. Furthermore, some teachers use these same materials as a testing device. There are some who have a feeling that language studies can be facilitated considerably by preparing animated pictures of root words, endings, prefixes, and so forth, to fix the combinations in the minds of the students. Again the phonograph record assumes an important role by bringing to the classroom, cheaply, illustrations of language which are thoroughly accurate in enunciation and pronunciation of Spanish, French, Italian, German, Russian, and other languages. And the short wave radio-receiving sets make it possible for language teachers to bring all types of foreign programs into the classroom.

The fields of science, including biological, physical, and general, have unlimited possibilities for the use of concrete materials of all types. Perhaps the majority of the teachers in these fields have been using some forms of visual aids regularly for the past several years. However, the newly developed microscopic, animated, stop-motion, and slow-motion pictures of life forms in their natural surroundings and normal activities can give to the class much clearer and more accurate impressions than can be obtained in any other way. The earlier discussion of the motion picture will provide numerous other suggestions as to the application of this valuable tool to the field of science. The "Have You Heard" series of radio programs presented by the Office of Education and "The World Is Yours" series presented by that Office in cooperation with the Smithsonian Institution are fine examples of scientific information presented interestingly over the radio. It is probable these and other fine scientific programs will be made available on phonograph records or transcriptions, which will increase and prolong their usefulness among schools.

In the field of fine arts there has been a gradual but slower development of materials. Collections of slides showing proper techniques for drawing and painting as well as slides of the famous artists of history are used extensively. The Metropolitan Museum of Art in New York City has prepared many interesting motion pictures of various parts of the museum as well as pictures of the techniques of making pottery, etching, carving, and painting. These films have been found to be of great value to those who desire to teach proper techniques in the early stages of art work. Furthermore, they provide excellent bases for comparison of technique.

The field of mathematics has received little attention among the producers of visual aids of various kinds. Of course various models have been used for number combinations and for advanced work in geometry and trigonometry, but there are only a few slides and motion pictures belonging or relating to the field of mathematics. There have been some plans laid for the production of such subjects, and it is expected that suitable materials will be available in the near future. However, many teachers of mathematics have found flash cards, number combination slides, and other visual aids to be of great value both for routine teaching and for review or testing. One of the most interesting recent developments is a series of stereographs for use in teaching solid geometry.

Constructive English and literature may be enhanced greatly by the introduction of pictures of various kinds. The disreputable method of teaching literature by dissection is finding itself discarded in favor of teaching with appropriately selected visual and sound aids. It has been found by closely checking the results of picture showings that when the picture of a novel is shown at a local theater there is a great increase in the calls for that book at the nearest library. This is among adults, of course, but the same seems to hold true of schools. Students who have an opportunity to see the motion picture "Julius Cæsar" are much more interested in the story. Those who have an opportunity to see "A Connecticut Yankee in King Arthur's Court," "The Headless Horseman," or "David Harum" have a greater appreciation of the authors and their works. Frequently such pictures can be shown as an introduction to a classic and, although some of the pictures are not absolutely true to the story, this fact alone will serve as a powerful motivating influence and will create many interesting discussions among members of the class.

The student who is learning to speak with conviction will be much better able to develop enthusiasm over his subject if he is

illustrating his talk with photographs, slides, motion pictures, or other visual aids. A motion picture, a series of slides, or a field trip to a nearby point of interest will provide ample material for many interesting written or oral essays. The experimental work of Dr. William Lewin, of Newark, indicates that the theatrical feature picture should be used more extensively as a basis for constructive English training. Certainly this plan is much to be preferred to the former plan of simply telling Johnny or Mary that a theme must be written on some subject and handed to the teacher the next morning.

Phonograph records of the great works of literature, interpreted by the world's outstanding authorities, have been found to be unusualy effective for use in classrooms. The radio programs which include similar selections provide excellent interpretations for the student of literature. Radio recording of great plays and other interpretations of the world's literature provide the finest listening experiences to students in schools of all sizes.

Audio-Visual Aids to Extra-Curricular Activities

There has been some suggestion in earlier discussion about the possibility of using various types of visual aids for extra-curricular work. The field of athletics offers the best opportunity to develop this type of activity, inasmuch as it is usually one of the branches of the school work which can be depended upon for some financial return. Coaches are finding the still and motion picture cameras to be of great value to them in training students and are finding many of the professionally produced films to be equally fine.

The different classes and other groups of the school will find many visual aids which can be used in connection with their programs. An International Relations Club, for example, might well use motion pictures and slides as well as mounted pictures of important current activities, peoples of other lands, and the like. A current events group might sponsor the use of newsreels as a part of the work of this interesting field. There are many school enterprises, also, which might make use of still and motion pictures. Great interest is developed by filming a play or a pageant, for example.

A new development in the use of educational talking pictures has been the preparation of teacher-training subjects by such well known authorities as Kilpatrick, Bode, Mearns, Allen, and others. These demonstration films can be brought to any classroom or

meeting in the United States at a very nominal charge, whereas it would cost hundreds of dollars to secure any one of these outstanding men for a lecture. Furthermore, the illustrations thus presented serve to enhance the values and possibilities of the lecture. The lecturer not only mentions activities of appropriate types but also presents living pictures of those activities as utilized in normal situations.

The administrator in charge of the school will find certain types of visual aids to be particularly helpful in connection with the school publicity program. The Camera Club mentioned earlier in this discussion can be depended upon for suitable illustrations of school activities to be placed on display in prominent public places or to be used as illustrations in publications for the patrons of the school. Local newspapers are always very anxious to have good illustrations to accompany stories of school events. People who read the newspapers usually read first those articles which are illustrated. The superintendent or principal will find that motion or still pictures of certain school activities, needed repairs or equipment, as well as other examples or good or bad situations, are very helpful in presenting recommendations to a board of education. Without such aids it is necessary, frequently, to waste much time in traveling from place to place to see situations which might be photographed easily and the picture transported to any convenient place for showing.

Sound and audio-visual aids offer even greater possibilities in the extra-curricular activities of the school. The production of radio programs to be broadcast over local stations for the entertainment and enlightenment of the community can do much to arouse community interest in the functions of the school. Many patrons of the school, who never visit the school buildings or classrooms, can be reached in their homes during those leisure hours when they have more time to think of the work which these schools are accomplishing.

Recorded debates may be sent from school to school where local debaters will be confronted with constructive speeches and somewhat formal rebuttals, which are occasionally more difficult to meet than when the debaters are present. This use of recording and reproducing apparatus provides an opportunity for inter-scholastic debates over a much wider area than could be attempted by sending debate teams to the schools of the opposing teams.

Sound equipment becomes especially necessary on the athletic field and on the playground where it is desirable to have announce-

ments, instructions, and music reach a large outdoor group. Similar equipment is almost as necessary in large auditoriums, particularly where speech must be carried to all parts of the auditorium in order to be understood clearly.

Band and orchestra work is aided materially by the use of phonograph records of the work of other bands and orchestras playing the sections which the high school band or orchestra is to learn. These records are used as patterns or goals to be reached by the band or orchestra. Instantaneous recordings of student performances provide the only objective measure of improvement and serve to stimulate student effort. Radio programs, particularly those in school band work which have been developed by Dr. Joseph E. Maddy of the University of Michigan, are used extensively by school bands throughout the United States. These programs provide for participation and do much to create interest in local band work.

Technique of Administration

The reading references which appear later in this handbook contain many suggestions which will be of assistance to those who are organizing visual instruction programs. Perhaps there is no better way to provide concrete suggestions than to quote one who has been responsible for organizing visual instruction services on a large scale and has accomplished satisfactory results. The following quotation is from a bulletin, "Visual Instruction in Our Schools," prepared by Mr. J. E. Hansen, Chief of the Bureau of Visual Instruction at the University of Wisconsin.

LOCAL ADMINISTRATION OF THE VISUAL INSTRUCTION PROGRAM. "Many of the administrative details connected with visual instruction require a closer study and more time than most teachers can afford from their regular classroom duties. The successful administration of a visual instruction program requires a technical knowledge of the mechanics of picture projection, an acquaintance with the various types of projection equipment, an acquaintance with the various sources of materials, and other important details. For the efficient administration of the local program the following suggestions are offered:

LOCAL DIRECTOR OF VISUAL INSTRUCTION. "A practice which has proved successful in a number of our Wisconsin schools is that of placing some teacher with a reduced teaching load in charge of this work. A good choice for this is a science teacher or some

other person with sufficient technical knowledge and administrative ability.

ORDERING VISUAL AIDS AND EQUIPMENT. "The local director should acquaint himself with all the various sources of visual aids and should be in a position to inform his teachers as to the availability of the materials which they need. He should keep abreast of the advances made in all phases of visual instruction so that he can recommend the type of equipment to purchase and offer suggestions as to where the latest and best pictures may be secured. He should be so qualified and so prepared that he may at all times act in an advisory capacity in the purchase or rental of materials. His office should serve as the channel through which all materials may be ordered.

INSTRUCTING LOCAL TEACHERS. "The local director should acquaint himself with the best visual aids teaching techniques and should strive to improve visual instruction in his classrooms both as regards the pedagogic and the mechanical aspects.

MAKING THE BEST AND WIDEST POSSIBLE USE OF AVAILABLE EQUIPMENT. "In one of our leading Wisconsin junior high schools the local director has worked out an ingenious method for making the school's four motion picture projectors available among the fifty or sixty teachers in the building. Each week a chart with spaces for each day and hour of the following week for the four projectors is posted. On this chart each teacher indicates the day or days and the hours during which he wishes to use one of the projectors. Thus the maximum use is gotten from each projector, with the greatest benefit to all concerned. With each projector goes a screen which may be mounted on hooks conveniently placed in the front of each classroom. Similar methods can be worked out for handling other materials also.

ADVANTAGES OF CENTRALIZED CONTROL AND RESPONSIBILITY. "Projectors and other materials are in constant need of expert care, and unless some one person is held responsible for their care, they will soon get into such a state of disrepair that they will have little value. It is also essential to centralize the responsibility for the routing of materials and equipment and to see that they are promptly returned.

THE COST OF VISUAL INSTRUCTION. "When consideration is given to the value received from a well planned and properly executed program of visual instruction, the necessary expenditure

will seem but nominal. An average annual per pupil expenditure of from fifty cents to one dollar will probably bring greater returns than any other like expenditure. It is as essential to make provision in the budget for the purchase of projection equipment and for the rental of motion pictures, lantern slides, etc., as it is to make provision for any other equipment or materials. Failure to make such provision denies the pupils of the respective educational systems the right to benefit from the latest and most effective aid to learning. While many school administrators and boards of administration have so far hesitated to make the necessary financial provision for its use, the very efficiency of the screen picture as compared with other devices will compel its general adoption for everyday classroom use, just as the textbook is now used.

SOUND AND SILENT MOTION PICTURES. "In the effort to sell sound motion pictures to the educational public, so much emphasis has been placed upon the value of sound motion pictures that school administrators may well have been led to believe that the silent film will become obsolete. The sound motion picture may well supplement the silent picture where sound is an essential element in the learning situation. It is doubtful that the off-stage fixed mechanical lecture of the talkies will ever be generally accepted by educators for use in elementary and secondary schools. It is to be hoped, however, that producers of sound films will produce a wealth of films in such fields as music, language and speech, great personalities and biography, and other fields in which sound will help to enrich learning.

THE IMPORTANCE OF PHOTOGRAPHY TO THE TEACHER. "Photography holds so many possibilities for the teacher that it seems a course in elementary photography ought to be included in every teacher-training program. The photographing of interesting and important events, objects, and places for the production of lantern slides for instructional purposes; the making of photographic records of trips and tours; and the making of photographic records of interesting phases of school life are but a few of the uses to which a camera in the hands of the teacher may be put."

The number and variety of available educational motion pictures is extensive. Schools may secure catalogs of films from the distribution centers listed on page 192. The majority of the state and regional film service bureaus publish lists for general distribution, including films of all types. Some films are furnished without

charge, some at nominal fees, and others at rentals which amortize the cost of production. A balanced program of educational films might include some of each, but it is only fair to state that those films which are available upon payment of rental fees are usually worth their cost, as compared with "free" films. There are numerous exceptions, of course, such as some films available from Federal Departments and large industries, but many carry a high percentage of direct advertising or propaganda for this or that movement.

The school which uses only rental films or those purchased for permanent use will miss some good educational subjects. On the other hand, those which use only the free films will encounter some sad experiences. A film on television, for example, which tells an interesting story and keeps advertising in the background may be an excellent teaching film. But, if such a film is filled with advertising or other propaganda, it has no place in the classroom.

The cost of good educational films, either for rental or purchase, is a relative matter. There are certain fixed costs, such as cost of production, cost of prints, cost of distribution, etc., which must be paid. The costs of prints and distribution are approximately the same on all films, while the cost of production varies, greatly. An educational film of high quality, which cost $15,000 or more to produce and is offered for sale at $30.00 to $45.00 for a 16-mm. print, may be a much better bargain than a poorly produced film priced at $20.00 or less. Furthermore, as the demand for prints increases, it is only logical to suppose that the selling prices and rental fees will be reduced appropriately. More important, a markedly greater use of films currently available will make it possible for the leading producers to provide more and better films. This applies equally to all types of audio-visual aids, and has a very direct bearing upon the equipment necessary for their use in teaching situations.

Sources of Information, Materials and Equipment

THE following sources are not complete, as a complete listing of publications alone would require space equivalent to that utilized for the entire Handbook. It is hoped that the sources mentioned will be of assistance in locating desired information, materials and equipment. Those who desire to do further reading or secure additional information concerning audio-visual aids and equipment should consult the Readers' Guide, film lists, equipment catalogs, educational bulletins and the like.

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HAYS, WILL H. Motion Pictures; an Outline of the History and Achievements of the Screen from Its Earliest Beginnings to the Present Day. Garden City, N. Y. Doubleday, Doran and Company, Inc., 1929, p. 504-533.

HOBAN, CHARLES F., HOBAN, CHARLES F. JR., AND ZISMAN, SAMUEL B. Visualizing the Curriculum. New York, The Cordon Company. 1937. 300 p.

HOLLIS, ANDREW P. Motion Pictures for Instruction. New York, The Century Co., 1926. 450 p. illus. (Century Education Series.)

JOHNSON, WILLIAM H. Fundamentals in Visual Instruction. Chicago, Ill. The Educational Screen, Inc., 1927. 104 p.

KOON, CLINE M. AND OTHERS. Motion Pictures in Education in the United States. A report compiled for the International Congress of Educational and Instructional Cinematography. Chicago, Ill., The University of Chicago Press, 1934. 106 p.

LEWIN, WILLIAM. Photoplay Appreciation in American High Schools. New York, D. Appleton-Century Company, 1934. 122 p. (National Council of Teachers of English. English Monograph No. 2.)

MCCLUSKY, FREDERICK DEAN. Visual Instruction; Its Value and Its Needs. A report . . . for Will H. Hays . . . New York, Mancall Publishing Corporation, 1932. 125 p.

THE MOTION PICTURE AND EDUCATION. Journal of Educational Sociology, Vol. 6, No. 4, December, 1932. p. 193-256.

NOBLE, CAROL LORRAINE. Four Star Scripts. 1935. New York, Doubleday-Doran Company, 1936.

SIGMAN, JAMES G. The Origin and Development of Visual Education in the Philadelphia Public Schools. Philadelphia, Pa. Temple University, 1933. 249 p.

WESTFALL, LEON H. A Study of Verbal Accompaniments to Educational Motion Pictures. New York, Bureau of Publications, Teachers College, Columbia University, 1934. 68 p. illus. tables, diagrs. (Contributions to Education No. 617.)

WOOD, BEN D. AND FREEMAN, FRANK N. Motion Pictures in the Classroom. Boston, Mass., Houghton Mifflin Company, 1929. 393 p. illus. diagrs.

*Radio in Education**

I. Information about Educational Programs—

1. Newspaper listings. These supply most accurate and up-to-date information on station schedules. They should be used as a check against other information obtained in advance. Listings are too brief, however, to give much help in selection or use of programs.
2. *Radio Guide.* A weekly periodical which gives classified listings of programs a week in advance. A special page called "Listen to Learn" is devoted to educational programs, and another section is devoted to serious music. Some programs are described in detail. On sale at newsstands at $.10 per copy. Yearly subscription, $4. Regal Press, Incorporated, 731 Plymouth Court, Chicago, Illinois.
3. Educational listings. These are often prepared and distributed by large school systems, *WPA* educational projects, or state departments of education. Programs are usually listed by subject-field and grade-level.
4. Local station advance listings. Local stations are usually willing to put schools on the mailing list for advance listings of programs and for publicity releases. Material from educational stations is usually particularly helpful.
5. *NBC Presents.* A monthly listing of educational and cultural programs of the NBC networks. Free on request to the National Broadcasting Company, RCA Building, Radio City, New York, New York.
6. *For the Student.* A weekly listing of educational and cultural programs of the CBS Network with considerable advance program details. Free on request to the Columbia Broadcasting System, 485 Madison Avenue, New York, New York.
7. *Educational and Cultural Programs from Chicago Stations.* A listing of selected programs available over NBC stations in Chicago. Free on request to the National Broadcasting Company, Merchandise Mart, Chicago, Illinois.

II. Information about School Broadcasts—

1. "NBC Music Appreciation Hour." An *Instructor's Manual*, price $.25, and a *Student's Notebook* for each of series A, B, C, and D, price $.10 each, are published annually, and copies may be secured by writing to NBC Music Appreciation Hour, National Broadcasting Company, RCA Building, Radio City, New York, New York.
2. "The American School of the Air." The Columbia Broadcasting System issues a free teacher's manual and classroom guide which may be obtained by writing to the American School of the Air, Columbia Broadcasting System, 485 Madison Avenue, New York, New York. This year there is a separate guide for each semester.
3. "The Nation's School of the Air." This broadcast series over the network of the Mutual Broadcasting System is prepared by Station WLW in Cincinnati. Teachers in Ohio, Indiana, Tennessee, Kentucky, and West Virginia may obtain manuals free. To others the cost is $.50. Address Station WLW, Cincinnati, Ohio.
4. "Your Health." This NBC weekly school broadcast is prepared by the American Medical Association. A manual, *Your Health*, may be obtained for $.25 from the Johnson Publishing Company, Richmond, Virginia.
5. "The Standard School Broadcast." This is an NBC regional school broadcast of music appreciation heard on the Pacific Coast. It is

produced by the Standard Oil Company of California. Free teacher's manual may be obtained by writing the Standard Oil Company, 225 Bush Street, San Francisco, California.

6. Regional school broadcasts. Some large radio stations support their own series of school broadcasts. Best examples are "School Time," of Station WLS, Chicago, and "Western New York School of the Air" of Station WBEN, Buffalo. Teaching materials are supplied by the stations.
7. State Schools of the Air. Best known are the Ohio School of the Air and the Wisconsin School of the Air. Both are conducted by state universities in co-operation with state departments of education and state teachers' associations. Manuals and teaching bulletins are prepared for these programs and can be secured free on request.
8. City school broadcasts. Detroit, Cleveland, Rochester, Chicago, New York, Alameda (California), Akron, and a number of other cities produce broadcasts for classroom use. Program announcements and teaching helps can be obtained by schools within the listening area of each city on request.

III. Books about Education by Radio—

1. Harrison, Margaret. *Radio in the Classroom.* New York: Prentice-Hall, Incorporated, 1937. $2.50.
2. Darrow, Ben H. *Radio, the Assistant Teacher.* Columbus, Ohio: R. G. Adams and Company, 1932. $1.90.
3. Hill, Frank. *Listen and Learn.* New York: American Association for Adult Education, 1937. $1.25.
4. MacLatchy, J., editor. *Education on the Air, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938.* Yearbooks of the Institute for Education by Radio. Columbus, Ohio: Ohio State University Press. $3.00 per volume.
5. Marsh, C. S., editor. *Educational Broadcasting, 1936, 1937.* Proceedings of the First and Second National Conferences on Educational Broadcasting. Chicago: University of Chicago Press. $3.00
6. Department of Research and Education of the Federal Council of the Churches of Christ in America. *Broadcasting and the Public.* New York: Abingdon Press, 1938. $1.50.
7. Eisenberg, Azriel L. *Children and Radio Programs.* New York: Columbia University Press, 1936. $3.00.
8. Koon, Cline M. "How to Use Radio in School." Laramie, Wyoming: University of Wyoming, 1937. $1.00. (Mimeographed)

IV. Pamphlets and Bulletins—

1. *Education by Radio.* A monthly bulletin devoted to the discussion of educational radio policy. Sent free on request to the National Committee on Education by Radio, One Madison Avenue, New York, New York.
2. *The News Letter.* A monthly bulletin bringing information to teachers about radio, motion pictures, and the press. Sent free on request to the editors, Bureau of Educational Research, Ohio State University, Columbus, Ohio.
3. Bartlett, Kenneth. *How to Use the Radio.* Washington, D. C. National Association of Broadcasters, 1937. Distributed free upon application to your local radio station. Deals with planning and broadcasting but not reception.
4. Koon, Cline M. *The Art of Teaching by Radio.* Washington, D. C.: Government Printing Office, 1933. $.10. May be obtained from the Superintendent of Documents, Washington, D. C. Deals chiefly with preparation and broadcasting of educational programs.

5. *Radio Manual, Glossary of Radio Terms, Handbook of Sound Effects,* and *Catalogue of Educational Radio Script Exchange.* Washington, D. C.: United States Department of the Interior, Office of Education Radio Project. These helps to amateur producers are available on request.
6. Page, Meredith. *Sound Effects for the Amateur.* Columbus, Ohio: Bureau of Educational Research, Ohio State University, 1937. $.25. (Radio Bulletin Number 14)
7. Lowdermilk, R. R. *Teaching with Radio.* Columbus, Ohio: Bureau of Educational Research, Ohio State University, 1938. Free. (Radio Bulletin Number 16)
8. Hogan, John V. L., and Wilmotte, R. M. *Auditory Aids in the Classroom.* New York: Committee on Scientific Aids to Learning, 1938. Free.
9. Co-operating Teachers and Staff of Evaluation of School Broadcasts Project. *How to Use the Radio in the Classroom.* Washington, D. C.: National Association of Broadcasters, 1939. Free through local radio stations.
10. Tyler, I. Keith, editor. *Radio in Education.* Washington, D. C.: Department of Supervisors and Directors of Instruction of the National Education Association of the United States, 1939. $.25. This bulletin is directed to the classroom teacher with practical suggestions for activities which he may pursue in making use of the radio.
11. "The Radio in Education," *The Phi Delta Kappan,* XXI (March, 1939). Fulton, Missouri: Ovid Bell Press, 1201 Bluff Street. $.35. An excellent overview of the whole field of educational broadcasting.

V. Orgazinations from Whom Information May Be Obtained—

1. Radio Project, United States Department of the Interior, Office of Education, Washington, D. C.
2. National Advisory Council on Radio in Education. This organization is no longer active but some pamphlet material is still available. Address: 60 East 42nd Street, New York.
3. National Committee on Education by Radio, One Madison Avenue, New York, New York.
4. Institute for Education by Radio, Ohio State University, Columbus, Ohio.
5. Radio Division, Bureau of Educational Research, Ohio State University, Columbus, Ohio.
6. Committee on Scientific Aids to Learning, 41 East 42nd Street, New York, New York.
7. Audio-Visual Education, Teachers College, Columbia University, New York, New York.
8. Women's National Radio Committee, 113 West 57th Street, New York, New York.
9. National Association of Broadcasters, 1626 K Street, N.W., Washtington, D. C.

I. Keith Tyler

*Reprinted from *The News Letter.* May, 1939, published by the Bureau of Educational Research, Ohio State University, Columbus, Ohio.

State and Regional Distribution Centers

A LARGE number of films and other visual aids—mainly educational—are now available from many state distributing centers. Terms of loan vary greatly. Write to the nearest center for full information and lists of materials available.

Arizona, Tucson—Max P. Vosskuhler, Director of Extension, University of Arizona.

California, Berkeley—Robert S. Johnson, Dept. of Visual Instruction, University of California. (Los Angeles Branch—815 Hill St.)

Colorado, Boulder—Miss Lelia Trolinger, Bureau of Visual Instruction, University of Colorado.

Florida, Gainesville—University of Florida. Miss Bernice Ashburn, Dept. of Audio-Visual Instruction.

Georgia, Atlanta—J. C. Wardlaw, General Extension Service, University System of Georgia.

Hawaii, Honolulu—Mrs. Etta R. Washburn, University Extension Division, University of Hawaii.

Illinois, Urbana—Lewis V. Peterson, Supervisor Visual Aids Service, 113 Education Building, University of Illinois.

Indiana, Bloomington—Mrs. Pauline J. Ellis, Acting Director, University Extension Division, Indiana University.

Iowa, Ames—H. L. Kooser, Visual Instruction Service, Iowa State College.
Iowa City—L. W. Cochran, Department of Visual Instruction, University of Iowa.

Kansas, Lawrence—Fred S. Montgomery, Bureau of Visual Instruction, Extension Division, University of Kansas.

Kentucky, Lexington—Louis Clifton, University Extension Division, University of Kentucky.

Louisiana, University—P. H. Griffith, Director of Extension, Louisiana State University and Agricultural and Mechanical College.

Maine, Orono—O. S. Lutes, Dean, School of Education, University of Maine.

Massachusetts, Boston—Helen B. Garrity, Director of Visual Instruction, State Department of Education.
Boston—Abraham Krasker, Director, Division of Teaching Aids, Boston University.
Cambridge—James R. Brewster, Director, Harvard Film Service, Harvard University.

Michigan, Ann Arbor—Dr. C. A. Fisher, Director, Extension Division, University of Michigan.

Minnesota, Minneapolis—H. B. Gislason, Head, Bureau of Visual Instruction, University of Minnesota.

Missouri, Columbia—Mrs. Margaret R. Kimes, In charge of Visual Education Service, University of Missouri.

New Hampshire, Durham—J. C. Kendall, Director, General Extension Service, University of New Hampshire.

New Jersey, Trenton—Miss Katherine Greywacz, State Museum.

New York, Buffalo—Buffalo Society of Natural Science.
Syracuse—Russell T. Gregg, Faculty Supervisor, School of Education, Syracuse University.

North Carolina, Chapel Hill—Charles F. Milner, In charge of Visual Instruction, University Extension Division, University of North Carolina.

North Dakota, Fargo—W. C. Palmer, Director of Visual Education, North Dakota State College.
Grand Forks—J. A. McCrae, University Extension Division, University Station.
Ohio, Columbus—B. A. Aughinbaugh, Visual Education Service, State Department of Education.
Oklahoma, Norman—R. Boyd Gunning, Director, Visual Education Department, Extension Division, University of Oklahoma.
Oregon, Corvallis—U. S. Burt, Visual Instruction Specialist, General Extension Service.
Pennsylvania, Lewisburg—H. W. Holter, Registrar, Class Room Film Library, Bucknell University.
Millersville—Milton H. Steinhauer, Sensory Aids Director, State Teachers College.
Philadelphia—Charles R. Toothaker, Commercial Museum.
Pittsburgh—James S. Kinder, Director, P. C. W. Film Service, Pennsylvania College for Women.
South Carolina, Columbia—H. H. Ward, Director, University Extension Division, University of South Carolina.
South Dakota, Vermillion—A. E. Mead, Director Department of Visual Education, University of South Dakota.
Tennessee, Nashville—A. F. Kuhlman, Director, Joint University Libraries, Vanderbilt University.
Texas, Austin—Mrs. Charles Joe Moore, Director, Visual Instruction Bureau, Division of Extension, University of Texas.
Canyon—Mrs. T. V. Reeves, Director, Film Division, Bureau of Public Service, West Texas State Teachers College.
Lubbock—J. F. McDonald, Director, Division of Extension, Texas Technological College.
Utah, Provo—Thomas Peterson, Bureau of Visual Instruction, Extension Division.
Vermont, Burlington—Robert Hull Fleming Museum, University of Vermont.
Washington, Ellensburg—Ernest L. Muzzall, Director of Public Service, Central Washington College of Education.
Pullman—Ford L. Lemler, Extension Division, Washington State College.
West Virginia, Morgantown—H. B. Allen, Director, Visual Education Service, College of Education, West Virginia University.
Wisconsin, Madison—J. E. Hansen, Bureau of Visual Instruction, University of Wisconsin.

Commercial Sources of 16-mm. Motion Pictures

THE following list of 16-mm. motion picture producers and distributors is not complete, but includes the names and addresses of several of the leading organizations. Those who desire thoroughly complete information concerning sources of motion pictures, should secure one or more of the four leading film directories. These are:

Educational Film Catalog, published by the H. W. Wilson Company, 950 University Avenue, New York City. Price $2.00.

Filmosound Library Catalog, published by Bell & Howell, 1801-1815 Larchmont Ave., Chicago, Ill. Price 25c.

"1000-And-One" Blue Book published by The Educational Screen, 64 East Lake Street, Chicago, Ill. Price 75c.

16-mm. Film Directory, published by the Victor Animatograph Corporation, Davenport, Iowa. Free.

It is advisable, usually, to secure film service through the nearest university extension division (see page 192) which has materials available for loan. The fees charged are low and the films are in first-class condition for showing.

Academy of Motion Picture Arts and Sciences, Hollywood, California.
1 film—"In the Days of Chivalry"—five-year lease—serve all U. S.

American Dental Association, 212 E. Superior St., Chicago, Illinois.
Films on dental health—rent—serve all U. S.

American Institute of Steel Construction, Inc., 200 Madison Ave., N.Y.C.
Films on structural steel—"free"—serve all U. S.

American Museum of Natural History, 77th Street and Central Park W,, N. Y. C.
Over 300 films—educational and industrial subjects—"free"—serve country east of Rockies.

American Social Hygiene Association, 450 Seventh Ave., New York City.
Social hygiene films—rent or sell to approved organizations—serve all U. S.

American Telephone & Telegraph Co., 195 Broadway, New York City.

Arnco Films, Inc., 1270 Sixth Ave., New York City.
Several scientific subjects including new 3-reel picture "Evolution."

Associated Screen News, Ltd., Western Ave. and Decarie Blvd., Montreal, Canada.
Educational and industrial subjects for distribution in Canada. Free and rental.

Atlantic Motion Picture Service, 739 Boylston St., Boston, Mass.
General educational and industrial and educational films—many "free," a few to rent—serve all U. S.

Beacon Films, Inc., 25 W. 45th St., New York City.
Educational, religious and travel subjects—rent—serve all U. S.

Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Educational and scientific subjects for sale. Excellent list of medical films.

Board of Foreign Missions of the Presbyterian Church, 156 Fifth Ave., New York City.
27 films—missionary and religious education—rent—serve all U. S.

Bollman, Henry, 20 Dixon St., Tarrytown, New York.
Films on aviation—sell—serve all U. S.

Boy Scout Foundation, 220 W. 42nd St., New York City.
Scout stories—rent or sell—serve all U. S.

Bray Pictures Corporation, Educational Dept., 729 Seventh Ave., N. Y. C.
About 1000 films—wide range of educational subjects—rent and sell —serve all U. S.—write for nearest exchange.

Bureau of Commercial Economics, Shoreham Hotel, Washington, D. C.
Many films—wide range of subjects—"free under our stipulations"—serve all U. S.

Burton Holmes Lectures, Inc., 7510 N. Ashland Ave., Chicago, Illinois.
Travel subjects—sell—serve whole world.

California Fruit Growers Exchange, Box 530. Station C, Los Angeles, California.
Various films on citrus industry for classroom use—"free"—serves all U. S.—distribute through Castle Films, 630 Ninth Ave., N. Y. C.

The Calvin Company, BMA Bldg., Kansas City, Missouri.
Industrial motion pictures for distribution throughout the U. S.

Canadian National Railways Motion Picture Library, Montreal, Canada.
Travel subjects—"free"—serve U. S. and Canada—through Passenger Representatives.

Canadian Government Motion Picture Bureau, Ottawa, Ont., Canada.
Industrial, scenic and educational subjects for distribution in Canada —distributed in the U. S. through University Extension Divisions.

Castle Films, R.C.A. Bldg., Rockefeller Center, New York City.
Educational-industrial subjects and a special service including the loan of projection equipment.

Chicago Film Laboratory, Inc., 1322 Belmont Ave., Chicago, Illinois.
Producers and distributors of educational and industrial films—"free" —serve all U. S.

Journal of Chemical Education, Washington, D. C.
Industrial subjects—"free"—rent—distributed to all points.

Cinecraft Company, 80 Boylston St., Boston, Mass.
Miscellaneous educational subjects for sale.

Columbia Pictures Corporation (Primarily Theatrical), 729 7th Ave., New York City.
Features and shorts in 16-mm.—entertainment—sell 16-mm.—serve all U. S. Exchanges in the following cities: Albany, Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Des Moines, Detroit, Indianapolis, Kansas City, Los Angeles, Milwaukee, Memphis, Minneapolis, New Haven, New Orleans, New York, Oklahoma City, Omaha, Philadelphia, Pittsburgh, Portland (Ore.), Salt Lake City, San Francisco, Seattle, St. Louis, Washington.

Consolidated Film Industries, 1776 Broadway, New York City.
Health and industrial subjects "free"—serve all U. S.

Cunard Steamship Co., Advertising Dept., 25 Broadway, New York City.
Travel films "free" shipped prepaid—serve all U. S.

Eastin Feature Films, Galesburg, Illinois.
Producers and distributors of home motion pictures—variety of subjects—36 films for rent, 260 for sale, 200 for exchange—serve all U. S.

Eastman Kodak Co., "Kodak Cinegraphs," Rochester, New York.
150 films—educational, entertainment, novelties—sell—serve all U. S. through Kodak dealers.

Eastman Kodak Company, Teaching Films Division, 343 State St., Rochester, N. Y.
Classroom films—made by teachers and correlated with study courses for schools and colleges—sale only.
Medical films—made by leading physicians and surgeons for medical

schools, hospitals, health associations, etc.—rent and sell—serve all United States.

Edited Pictures System, Inc., 330 W. 42nd St., New York City.
Educational, religious and entertainment—rent and sell—serve all United States.

Ellis, Carlyle, 53 Hamilton Terrace, New York City.
Health and social service subjects—and 16-mm.—sell—serve all U. S.

Films of Commerce, Inc., 35 W. 45th St., New York City.
Commerce and industry, health, home economics—non-flam—sell and "free"—serve all U. S. from local exchanges.

Films, Inc., 330 W. 42nd St., New York City.
A large collection of 16-mm.—several subjects, including theatrical productions.

Garrison Film, 729 Seventh Ave., New York City.
16-mm. reduction prints of the Amkino (Russian) films and other subjects of international interest.

General Biological Supply House, 761 E. 69th Pl., Chicago, Illinois.
Science subjects—sell and loan "free"—serve all U. S.

General Electric Company Publicity Dept., Schenectady, New York.
Industrial subjects—sell and loan "free"—serve all U. S: Exchanges in the following cities: Atlanta, Boston, Cleveland, Dallas, Chicago, Berkeley (Dept. of Visual Instruction, University of California), Philadelphia, Portland (Ore.), Salt Lake City.

General Films, Ltd., 1924 Rose St., Regina, Sask., and 156 King St., Toronto, Canada.
Educational and industrial subjects for distribution in Canada. Free and rental.

Goodyear Tire & Rubber Company, Akron, Ohio.
Industrial films—"free"—serve all U. S.

Gordon Ellis Productions, 35 W. 45th St., New York City.
Great number of educational and entertainment subjects, including Pathe instructional films—rent and sell—serve all U. S. from local exchanges.

Harcol Motion Picture Industries, 610 Baronne St., New Orleans, La.

Hercules Powder Company, Wilmington, Delaware.
Industrial films—"free"—serve all U. S.

Herman Ross Enterprises, 630 Ninth Ave., New York City.
General educational subjects—rent or sell—serve all U. S.

Hollywood Film Enterprises, Inc., 6060 Sunset Blvd., Hollywood, Calif.
600 films—educational and entertainment—exclusive distributors for all Walt Disney cartoons in 16-mm. silent—sell; rent only in Southern California.

Home Film Libraries, Inc., 500 Fifth Ave., New York City.
Entertainment—rent and sell—serve all U. S. through 50 photographic dealers.

Ideal Pictures Corporation, 30 East Eighth St., Chicago, Illinois.
Industrial and educational subjects for sale and for loan.

Institutional Cinema Service, 622 Ninth Ave., New York City.
More than 500 educational, scientific, and travel subjects for sale.

International Dental Health Foundation for Children, Inc., 130 E. End Ave., New York City.
Dental health and nutrition—rent and sell—serve all U. S.—write headquarters for nearest source.

Jam Handy Organization, 2900 East Grand Blvd., Detroit, Michigan.
Industrial subjects—"free"—covers all U. S.

Kodascope Libraries, Inc., 33 West 42nd St., New York City.
About 500 films—general educational and entertainment subjects, many theatrical features reproduced—rent—serve all U. S. exchanges in the following cities: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, Kansas City, Los Angeles, Minneapolis, New York City, Philadelphia, Pittsburgh, Rochester, San Francisco, Seattle.

Leggett. J. Alexander. 509 Fifth Ave., New York City.
Industrial subjects—"free"—serve all U. S.

Methodist Episcopal Church, Board of Education, 740 Rush St., Chicago, Illinois.
Educational enterprises—"free" serve all U. S.

Metropolitan Motion Picture Co., 108 West 34th St., New York City.
Over 100 films—educational and entertainment—rent and sell—serve all U. S.

Metropolitan Museum of Art, 5th Ave. at 82nd St., New York City.
Art subjects—rent and sell—serve all U. S.

Missouri Game and Fish Department, Jefferson City, Missouri.
Hunting, fishing and conservation—"free"—serve all U. S., but Missouri especially.

Modern Woodmen of America, Rock Island, Ill.
Health, science and fraternal—"free"—serve all U. S.

Mogull Brothers, Electrical Corp., 1944 Boston Rd., New York City.
About 100 films—all subjects—rent and sell—serve all U. S.

National Motion Picture Company, Holliday Bldg., Indianapolis, Ind.
Health and safety subjects—rent, sell and some "free"—serve all United States.

National Tuberculosis Association, 450 Seventh Ave., New York City.
Films on tuberculosis—sell—serve all U. S.

Northern Baptist Convention, 152 Madison Ave., New York City.
Many films on missions and religious activities—rent, "free" to own denomination—serve all U. S.

Northern Pacific Railway, Passenger Traffic, St. Paul, Minnesota.
Scenics of the Northwest—"free"—serve all U. S.

Pathegrams, Inc., 35 West 45th St., New York City.
Large library—educational and entertainment subjects—sell—serve all U. S.

Pinkney Film Service, 1028 Forbes St., Pittsburgh, Pa.
Educational and religious subjects—rent and sell—serve Pennsylvania, West Virginia and Ohio.

Ray-Bell Films, Inc., 817 University Ave., St. Paul, Minnesota.
Scenic and industrial—sell and "free"—serve all U. S.—producers of industrial, educational and animated pictures.

Religious Motion Picture Foundation, Inc., 140 Nassau St., New York City.
About 25 films—religious and missionary subjects—rent and sell—serve all U. S.

Roosevelt Memorial Association Film Library, 28 E. 20th St., N. Y. C.
10 films—Roosevelt series—rent and sell—serve all U. S.

Rowland Rogers Productions, 151 W. 46th St., New York City.
General educational subjects—rent, sell and "free"—serve all U. S. through state universities.

Society of Natural Sciences of New York, Buffalo, New York.
Scientific films for Buffalo and vicinity.

Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
General educational subjects—rent and sell—serve all U. S.

United Projector & Film Corporation, 228 Franklin St., Buffalo, N. Y.
Large number of films—educational, religious, entertainment—mostly 16-mm. also Hepworth subjects—rent, sell and a few 16-mm. "free"—serve territory east of Mississippi.

United States Government Departments and Bureaus, Washington, D. C.
(Note: The following offer motion picture service to schools and other educational organizations or groups; mostly free on loan or for sale at print cost.)
U. S. Department of Agriculture, Office of Motion Pictures, Washington, D. C.
U. S. Department of the Interior, Div. of Motion Pictures, Washington, D. C.
U. S. Department of the Interior, Bureau of Mines, 4700 Forbes St., Pittsburgh, Pennsylvania.
U. S. Department of Labor, Women's Bureau, Washington, D. C.
U. S. Navy Department, Bureau of Navigation, Washington, D. C.
U. S. Treasury Department, Bureau of Public Health, Washington, D. C.
U. S. Veterans Bureau, Washington, D. C.
U. S. Resettlement Administration, Washington, D. C.

Universal Pictures Corporation, RCA Building, Rockefeller Center, Radio City, New York City.
Reduction prints of outstanding feature pictures with educational content.

University Film Foundation, 40 Oxford St., Cambridge, Mass.
24 films—exclusively educational; in collaboration with Harvard University—fine arts, travel, natural science, industrial subjects—sell—2 for rent—serve all U. S.

Visugraphic Pictures, Inc., 247 Park Ave., New York City.
10 films—aviation, travel and industrial—"free"—serve all U. S.

Warner Brothers Pictures, Inc., New York City.
Historical short pictures (1-2 reels) and feature films based on literature, travel and history.

Wholesome Films Service, 48 Melrose St., Boston, Mass.
Educational, religious, health, industrial, entertainment, and some theatrical features—rent, sell, a few "free"—serve all U. S. but especially New England.

Wild Flower Preservation Society, 3740 Olive St., Washington, D. C.
Films on wild flowers—rent and sell—serve all U. S.

Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia, Pa.
Complete motion picture service for loan or for sale serving Eastern United States.

Yale University Press Film Service, 396 Fourth Ave., New York City.
Distributors of "The Chronicles of America Photoplays," produced by the Yale University Press—rent or lease—obtainable from many different sources throughout the country, but arrangements should always be made direct with headquarters.

Y. M. C. A., National Council of Motion Picture Bureau, 347 Madison Ave., New York City.
About 500 films—all subjects—rent and many "free"—serve all U. S.

Sources of Exhibits, Pamphlets and Charts Available from Industries

Animal Products

Armour & Co., Chicago, Illinois.
Motion picture "The Romance of Food," available through National Council of Young Men's Associations, 347 Madison Avenue, New York, N. Y. Attn.: Mr. A. L. Frederick, Associate Director.

Kraft-Phoenix Cheese Corp., 400 Rush Street, Chicago, Illinois.
Recipe folders and booklet of "Favorite Recipes." Educational booklet "The Romance of Cheese." 16-mm. motion picture "Triumph of the Century." Free to teachers.

Cereals

Kellogg Company, Home Economics Department, Battle Creek, Michigan.
Folders—"Food for Growing Boys and Girls," "Facts about Kellogg's" and Health Score Charts. Free to teachers. Information regarding the film "The Story of Corn" can be obtained by writing the Castle Film Company, RCA Building, Rockefeller Center, New York, N. Y.

American Institute of Baking, Dept. of Nutrition, 9 Rockefeller Plaza, New York, N. Y. Interesting pamphlets, "The Physician and Our Daily Bread," "The Right Way to Right Weight" and "The Wheel of Good Health" poster regarding varied and balanced diet. Free to teachers.

Pan American Union, Washington, D. C.
Interesting booklets on countries, cities, commodities, etc., of the Pan-American Republic. (5c each)

Pillsbury Flour Mills Company, Minneapolis, Minnesota.
Educational exhibit 38x50 wall chart on wheat and flour production, 50c. Booklet "The Story of Flour," free. One to a person.

Forest Products

Armstrong Cork Company, Lancaster, Pennsylvania.
16-mm. silent film "For the Feet of a Nation" and 35-mm. silent film "Insulation Film" free. Linoleum educational exhibit $1.00 and cork educational exhibit $2.00.

Chicago Cork Works Co., 2600 North Crawford Avenue, Chicago, Illinois.
Very complete exhibits of cork material, showing manufacture and finished products. $1.00 each.

Hammermill Paper Company, Erie, Pennsylvania.
Silent motion picture film "The Voice of Business" available for either 35-mm. or 16-mm. (Free.)

Strathmore Paper Company, West Springfield, Massachusetts.
Booklets "Making Expressive Strathmore Papers" and "Psychology of Paper in Advertising and Correspondence," free. Bottle exhibit of paper in various stages of manufacture. $1.00.

Fruits

California Fruit Growers Exchange, Educational Division, Los Angeles, California.
Two 16-mm. films, silent or sound, "The Golden Journey" and "Citrus on Parade" obtained free through Castle Films, RCA Building, 30 Rockefeller Plaza, New York, N. Y. Pamphlet for primary grades with illustrations to be colored. An illustrated map folder for intermediate grades. Also booklets on lemons and oranges, recipes and health information available in limited quantities. Free for class work.

Geography Materials

Alaska Steamship Company, Seattle, Washington.
"Good Natured" map of Alaska (free to teachers). Booklets "Alaska Ahead" and "Scenery Ahead in Alaska." (Free.)

Mineral Products

Barber Asphalt Company, Barber, New Jersey
Booklet "The Wonderland of Trinidad." (Free.) Pictorial map of the Island of Trinidad. (10c)

The Cambridge Glass Company, Cambridge, Ohio.
Interesting booklet "The Art of Making Fine Glassware" and many other pamphlets. (Free.)

The Georgia Marble Company, Tate, Georgia.
Booklet "The Story of Georgia Marble."

Textiles

American Thread Company, Inc., New York, N. Y.
Booklet "The Story of Cotton Thread." (Free.)

Botany Worsted Mills, Passaic, New Jersey.
Booklet, fabric and yarn primers. (Free.) Exhibit showing the processing of raw wool into the finished product. ($1.00) 16-mm. motion picture (silent and sound). Write for information.

Celanese Corporation of America, 180 Madison Avenue, New York, N. Y.
Samples of rayon fabrics and booklets with information regarding their care. Available to teachers free.

L. C. Chase and Co., Advertising Dept., 295 Fifth Avenue, New York City.
Silent 16-mm. motion picture "Story of Mohair" and booklet containing cleaning suggestions "On the Spot." (Free to teachers.)

Real Silk Hosiery Mills, Inc., Indianapolis, Indiana.
Booklet "The Legend of Silk," a cocoon and miniature skein of raw silk for distribution to teachers and students.

Singer Sewing Machine Company, Educational Dept., Singer Building, New York, N. Y.
16-mm. silent motion picture "Modern Industrial Methods" containing material suitable for classes in sewing, manual training, chemistry, physics, engineering, English, hygiene, etc. (Free to schools.) Educational publications for teachers and students.

William Skinner and Sons, 222 West Adams St., Chicago, Illinois.
Illustrated booklets "The Story of Silk" and "The Romantic Story of Silk."

Miscellaneous

The American Sugar Refining Company, 120 Wall Street, New York, N. Y.
Text "The Story of Sugar" and Domino Sugar educational exhibit. Limited one to a school and to urban communities (east of the Mississippi River) where there is representative distribution for Domino Sugars.

Hershey Chocolate Corp., Hershey, Pennsylvania.
16-mm. and 35-mm. sound film "The Gift of Montezuma" and 16-mm. silent picture "The Story of Chocolate and Cocoa." Educational wall chart and supplementary booklet "The Story of Chocolate and Cocoa." Recipe books for Home Economics classes. Above material available to teachers only.

Clay-Adams Company, Inc., 44 East 23rd Street, New York, N. Y.
Very complete assortment of biological and other scientific specimens, models, charts, etc. Write for catalog.

Denoyer-Geppert Company, 5235 Ravenswood Avenue, Chicago, Illinois.
16-mm. sound film "Anatomical Models." Booklets "Aquariums and Terrariums in Your Classroom," "B3 Fundamental Maps," "B13 Vitalized Latin," free to teachers.

General Biological Supply House, 761 East 69th Place, Chicago, Illinois.
Biological and other scientific materials for school use. Write for literature.

General Electric Company, Visual Instruction Section, 230 South Clark Street, Chicago, Illinois.
A large selection of motion pictures and filmslides lent free to schools, churches, civic and business clubs. Write for catalog.

Goodyear Tire and Rubber Company, Inc., Motion Picture Department, Akron, Ohio, or Los Angeles, California.
Silent films free. Write for booklet.

Hills Bros. Coffee, Inc., 2 Harrison Street, San Francisco, California.
Booklet "Coffee—How It's Grown and How to Make It." (Free.) 35-mm. motion picture "Behind the Cup" available through the Bass Camera Company, 179 W. Madison Street, Chicago, Illinois, The Ideal Pictures Corp., 28 E. 8th Street, Chicago, Illinois, and the Film Library of the University of Illinois, Urbana, Illinois.

International Harvester Company, 606 Michigan Avenue, Chicago, Ill.
Many sound-on-films motion pictures available in both 16-mm. and 35-mm sizes. Write for folder "Sound Motion Pictures." (Free.)

Libby, McNeill & Libby, Sales Promotion Dept., Chicago, Illinois.
Filmslides in sound "The People's Choice," "Let's Go in the Movies" and "Doubled and Redoubled" available free for classes in advertising, merchandising and retail salesmanship in high schools and colleges

New York Zoological Park, New York, N. Y.
130 Animal Art Stamps. Photographs of animals taken in the New York Zoological Park. Contains carefully written captions giving authentic information of real educational value. Album with 10 stamps to start your collection, 25 cents; postage 3 cents. Remaining 120 subjects sold in sets of 20 stamps each, 10 cents per set.

Spencerian Pen Company, 434 Broadway, New York, N. Y.
Chart "The Development of the Art of Writing" and booklets "Little Lessons in Pen Drawing," "Spencerian Broad-Edge Bulletin." (Free.) Complete set of twenty-six Famous American Documents and Letters with text book, $1.00.

Visual Equipment and Supplies

Maps, Charts and Globes

Denoyer-Geppert Company, 5235 Ravenswood Ave., Chicago, Illinois.
National Geographic Society, Sixteenth and M Sts., Washington, D. C.
A. J. Nystrom & Co., 3333 Elston Ave., Chicago, Illinois.
Weber Costello Company, Chicago Heights, Illinois.

Photographs and Prints

Art Extension Press, Inc., Westport, Connecticut.
Colonial Art Company, Oklahoma City, Oklahoma.
Division of Motion Pictures, U. S. Department of Interior, Washington, D. C.
George Washington Memorial Association, 386 Fourth Ave., N. Y. C.
International Art Prints, 64 East Lake St., Chicago, Illinois.
National Geographic Society, Sixteenth and M Sts., Washington, D. C.
Orthovis Printing Company, Chicago, Illinois.
Perry Pictures Company, Box 4, Malden, Massachusetts.
Photographic History Service, 5127 Franklin Ave., Hollywood, Calif.
Poster-Lesson-Course, Scientific Education Publishers, Los Angeles, Calif.
James G. Sawders, Nutley, N. J.
Travel Information Bureau, Swedish State Railways, 551 Fifth Ave., New York City.
Wild Flower Preservation Society, 3740 Oliver St., Washington, D. C.
Yosemite Park & Curry Company, Yosemite National Park, California.

Opaque Projectors

Bausch & Lomb Optical Company, Rochester, New York.
Spencer Lens Company, Buffalo, New York.
Trans-Lux Daylight Picture Company, 247 Park Ave., New York City.

Stereographs and Stereoscopes

Keystone View Company, Meadville, Pennsylvania.
E. Leitz, Inc., 60 East 10th St., New York City.

Glass Slides

Bailey Art Slide Company, 21 Lake Ave., Newton Center, Massachusetts.
Conrad Slide and Projection Company, Superior, Wisconsin.
Fairchild Aerial Surveys, Inc., 224 East 11th St., Los Angeles, California.
H. E. Floercky, 543 Muirfield Rd., Los Angeles, California.
International Art Prints, 64 East Lake St., Chicago, Illinois.
Keystone View Company, Meadville, Pennsylvania.
Division of Motion Pictures, Department of the Interior, Washington, D. C.
Henry G. Peabody, Pasadena, California.
Photographic History Service, 5127 Franklin Ave., Hollywood, Calif.
Sims Visual Music Company, Quincy, Illinois.
Victor Animatograph Company, Davenport, Iowa.

Slide-Making Materials

(Etched glass, colored inks, colored pencils, cellophane, lumarith, slide mats, cover glasses, etc.)
Celluloid Corporation, 290 Ferry St., Newark, New Jersey.
Eastman Kodak Company, Rochester, New York.

Keystone View Company, Meadville, Pennsylvania.
National Theatre Supply Company, 90 Gold St., New York City.
(Branches in 26 principal cities.)
Radio Mat Slide Company, Inc., 1819 Broadway, New York City.
Scarborite Colors, Inc., Scarborough-on-Hudson, New York.
Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
(For 2″x2″ slides.)
Victor Animatograph Company, Davenport, Iowa.

Glass Slide Projectors

Bausch & Lomb Optical Company, Rochester, New York.
Charles Beseler Company, 131 East 23rd St., New York City.
Keystone View Company, Meadville, Pennsylvania.
Spencer Lens Company, Buffalo, New York.
Victor Animatograph Company, Davenport, Iowa.

Filmslides

Division of Motion Pictures, Department of the Interior, Washington, D. C.
Eye Gate House, Inc., 330 W. 42nd St., New York City.
General Electric Company, Motion Picture Division, Schenectady, New York.
Long Filmslide Service, 944 Regal Road, Berkeley, Calif.
Nature Study Illustrated, San Jose State Teachers College, San Jose, California.
Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
The Stanley Bowmar Co., 2929 Broadway, New York.
United States Department of Agriculture, Washington, D. C.
University Museum Extension Lecture Bureau, 10 So. 18th St., Philadelphia, Pennsylvania.
Visual Instruction Service, University Museum, University of Pennsylvania, Philadelphia, Pennsylvania.

Filmslide Cameras

Agfa-Ansco Corporation, Binghamton, New York.
Eastman Kodak Company, Rochester, New York.
Folmer-Graflex Corporation, Rochester, New York.
International Industries, Inc., Ann Arbor, Michigan.
E. Leitz, Inc., 60 East 10th St., New York City.
Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
Carl Zeiss, Inc., 485 Fifth Ave., New York City.

Filmslide Projectors and Attachments

Bausch & Lomb Optical Company, Rochester, New York.
Eastman Kodak Company, Rochester, New York.
International Industries, Inc., Ann Arbor, Michigan.
E. Leitz, Inc., 60 East 10th St., New York City.
Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
Spencer Lens Company, Buffalo, New York.
Victor Animatograph Company, Davenport, Iowa.

Film Cabinets

Methods of storing film methodically are provided by modern fireproof film cabinets. They are available in units holding from three to twelve reels, and some are so arranged that on opening the cover the reel is raised and brought within grasp. Each reel occupies an individual compartment heat-insulated from all others. Arrangements for outside ventilation are also provided.
American Film-Safe Corporation, 1800 Washington Blvd., Baltimore, Maryland.

Belson Manufacturing Company, 800 Sibley St., Chicago, Illinois.
Chicago Cinema Products Company, 1736 North Springfield Ave., Chicago, Illinois.
E. E. Fulton Company, 1018 South Wabash Ave., Chicago, Illinois.
Good-All Electric Manufacturing Company, 251 Spruce St., Ogallala, Neb.
National Theatre Supply Company, 92-96 Gold St., New York City.
Neumade Products Corporation, 427 West 42nd St., New York City.
Wenzel Company, 2507 South State St., Chicago, Illinois.
Edw. H. Wolk, 1018 South Wabash Ave., Chicago, Illinois.

Film Cement

This adhesive is a special preparation for splicing motion picture film—indispensable to all who use motion pictures.

Ampro Corporation, 2839 North Western Ave., Chicago, Illinois.
Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
H. A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Hewes-Gotham Company, 520 W. 47th St., New York City.
National Theatre Supply Company, 92-96 Gold St., New York City.
Neumade Products Corporation, 427 West 42nd St., New York City.
Safety Projector Company, 310 West 2nd St., Duluth, Minn.

Film Cleaning Machines

With these devices, dirt, oil and grit are removed by running the film between pads saturated with a cleaning fluid.

Andre DeBrie, Inc., 115 West 45th St., New York City.
Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
National Theatre Supply Company, 92-96 Gold St., New York City.
Neumade Products Corporation, 427 West 42nd St., New York City.

Lamps—Projection

(At least one extra lamp should be purchased with any projector. Additional lamps can be secured from the manufacturer of the equipment or from one of the following distributors.)

Ampro Corporation, 2839 North Western Ave., Chicago, Illinois.
Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
National Theatre Supply Company, 90 Gold St., New York City.
Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
Victor Animatograph Company, Davenport, Iowa.

Adapters for Incandescent Lamps

Any carbon arc projector can be converted to mazda operation by means of adapters consisting essentially of a bracket, an adjustable arm, and a reflector to be located behind the lamp. The device is clamped to the lower carbon jaw.

Best Devices Company, Film Building, Cleveland, Ohio.
Fish-Schurman Corp., 230 E. 45th St., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Good-All Electric Manufacturing Company, 251 Spruce St., Ogallala, Neb.
J. H. Hallberg, 303 Fourth Ave., New York City.
Monarch Theatre Supply Company, 494 S. Second St., Memphis, Tenn.
National Theatre Supply Company, 92-96 Gold St., New York City.

Lights—Spot and Flood

In the production of motion pictures and in presenting pageants, plays, etc., spot and flood lighting is important. The companies listed below will be able to recommend lighting required for any special situation.

Brenkert Light Projector Company, 7348 St. Aubin Ave., Detroit, Mich.
Chicago Cinema Products Company, 1736-1754 N. Springfield Ave., Chicago, Illinois.

General Electric Co., Schenectady, N. Y.
Kliegl Brothers, 321 W. 50th St., New York City.
National Theatre Supply Company, 92-96 Gold St., New York City.
Neumade Products Corporation, 437 West 42nd St., New York City.
Weaver Manufacturing Company, 1639 E. 102nd St., Los Angeles, Cal.
Wm. Wurdack Electric Manufacturing Company, 4444 Clayton Ave., St. Louis, Missouri.

Tripods and Accessories

Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Craig Movie Supply Company, Los Angeles, Cal.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Neumade Products Corporation, 427 West 42nd St., New York City.
Thalhammer, Ltd., 123 So. Fremont Ave., Los Angeles, Cal.
Victor Animatograph Corporation, Davenport, Iowa.

16-mm. Motion Picture Projectors (Silent)

Ampro Corporation, 2839 North Western Ave., Chicago, Illinois.
Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Eastman Kodak Company, Rochester, New York.
International Projector Corporation, 90 Gold St., New York City.
Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
Victor Animatograph Company, Davenport, Iowa.

Exposure Meters

Western Electrical Instrument Corporation, Newark, New Jersey.
Willoughbys, 10 W. 32nd St., New York City.

Film Titling and Editing Service

Amateur Cinema League of America, 105 West 40th St., New York City.
The Calvin Company, B. M. A. Building, Kansas City, Missouri.
Kodascope Libraries, Inc., 33 West 42nd St., New York City.

16-mm. Motion Picture Cameras

Agfa-Ansco Corporation, Binghamton, New York.
Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Eastman Kodak Company, Rochester, New York.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
International Projector Corporation, 90 Gold St., New York City.
Victor Animatograph Corporation, Davenport, Iowa.

35-mm. Motion Picture Cameras

Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Andre Debrie, Inc., 115 W. 45th St., New York City.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Universal Camera Company, 361 W. Ontario St., Chicago, Illinois.

Screens for Projection

Bausch & Lomb Optical Company, Rochester, New York.
Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Crystal Movie Screen Corporation, Celina, Ohio.
Da-Lite Screen Company, Inc., 2723 N. Pulaski Road, Chicago, Illinois.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Eastman Kodak Company, Rochester, New York.
Keystone View Company, Meadville, Pennsylvania.
National Theatre Supply Company, 90 Gold St., New York City.
Raven Screen Corporation, 145 East 24th St., New York City.
R. C. A. Manufacturing Company, Inc., Educational Department, Camden, New Jersey.

Society for Visual Education, Inc., 100 E. Ohio St., Chicago, Illinois.
Spencer Lens Company, Buffalo, New York.
Trans-Lux Daylight Picture Screen Corporation, 1270 Sixth Ave., New York City.
Victor Animatograph Corporation, Davenport, Iowa.

Booths—Projection

(Get specifications from local and state fire marshal. Booth unnecessary for projection of "Safety" prints in many states and cities.)
Anchor Corrugating Construction Company, 130 West 42nd St., New York City.
E. E. Fulton, 1018 South Wabash Ave., Chicago, Illinois.
Johns-Manville Company, 292 Madison Ave., New York City.

Film Splicing, Rewinding and Editing Equipment

Bell & Howell Company, 1801 Larchmont Ave., Chicago, Illinois.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Eastman Kodak Company, Rochester, New York.
E. E. Fulton, 1018 South Wabash Ave., Chicago, Illinois.
National Theatre Supply Company, 90 Gold St., New York City.
Neumade Products Corporation, 427 West 42nd St., New York City.
Victor Animatograph Corporation, Davenport, Iowa.

Screen Paints

Paint for resurfacing motion picture screens is available in flat white and metallic types. Although no resurfacing material can restore completely the original reflective capacity of a screen, paint of proper mix and pigmentation can effect much improvement if applied with sufficient expertness to insure uniformity of surface: In resurfacing perforated screens, care must be taken to prevent filling of the holes.
Da-Lite Screen Company, Inc., 2723 N. Pulaski Road, Chicago, Illinois.
Hewes Gotham Company, 520 W. 47th St., New York City.
National Theatre Supply Company, 92-96 Gold St., New York City.
Neumade Products Inc., 437 West 42nd St., New York City.
The Original Re-Nu Screen Surface Company, 5535 Grace St., Chicago, Ill.
Volland Studios, 3737 Cass Ave., St. Louis, Mo.
Walker American Corporation, 800 Beaumont St., St. Louis, Mo.

Curtain Control Machines

Smooth and silent opening and closing of curtains are effected, either from backstage or from the projection room controls, by automatic machines that operate at the touch of a button. The curtain may be stopped at any point along the stage, or its motion reversed as desired.

The equipment consists of a motor, a track and a cable, as well as snaps to which the curtain is fastened. Special models for small auditoriums are available at relatively low cost.
Acme Stage Equipment Company, 191 Lafayette St., New York City.
Automatic Devices Company, Samuels Building, Allentown, Pa.
J. H. Channon Corporation, 1447-1455 West Austin Ave., Chicago, Ill.
Cinema Supplies, Inc., 36-40 Glenwood Ave., Minneapolis, Minn.
Electric-Air, Inc., 308 Monroe Ave., Grand Rapids, Mich.
Metropolitan Scenic Studios, Inc., Omaha, Neb.
National Theatre Supply Company, 92-96 Gold St., New York City.
Tiffin Scenic Studios, Tiffin, Ohio.
Twin City Scenic Company, 2819 Nicolet Ave., Minneapolis, Minn.
Vallen, Inc., 225 Bluff St., Akron, Ohio.
Volland Studios, 3737 Cass Ave., St. Louis, Mo.
Weaver Manufacturing Company, 1639 E. 102nd St., Los Angeles, Cal.

Sound Equipment

Acoustical Products

Acoustical treatment for the school auditorium and certain classrooms in which motion pictures, phonograph records, radio programs, etc., are used is sometimes necessary in order to get the most satisfactory results. Materials most frequently used are sound absorbent tiles, acoustic plaster, rock wool and similar products. Most manufacturers of acoustic materials can supply reliable acoustical recommendations.

Armstrong Cork Co., Lancaster, Pa.
Atlantic Gypsum Company, Boston, Mass.
Atlas Sound Corp., 1451 39th St., Brooklyn, N. Y.
The Celotex Company, 919 N. Michigan Ave., Chicago, Illinois.
Colortone, Inc., Sturgis, Michigan.
Electrical Research Products, 250 West 57th St., New York City.
Garrison Engineering Corp., 51 Church St., Great Barrington, Mass.
General Insulating & Manufacturing Company, Alexandria, Ind.
Good-All Electric Mfg. Co., 251 Spruce St., Ogallala, Neb.
Johns-Manville Corporation, 22 East 40th St., New York City.
Masonite Corp., 111 West Washington St., Chicago, Illinois.
National Theatre Supply Company, 92-96 Gold St., New York City.
Transformer Corporation of America, 69 Wooster St., New York, N. Y.
United States Gypsum Company, 300 W. Adams St., Chicago, Illinois.
Universal Gypsum & Lime Company, 105 W. Washington St., Chicago, Ill.
Western Felt Works, 4029-4133 Ogden Ave., Chicago, Ill.
Wood Conversion Company, First National Bank Bldg., St. Paul, Minn.

Amplifiers

In function, as part of a sound reproduction system, these are panels or cabinets that take sound current from the photoelectric cell (or other source) and use it as a pattern for the release of a similar but vastly more powerful current for operation of the loudspeakers. Modern compact apparatus may have an amplifying power of ten billion to one.

Amplifiers today need only connection with an a.c. or d.c. power line, dispensing with all auxiliary batteries, generators or rectifiers and in addition commonly supply polarizing voltage to photocells, and sometimes current to exciter lamps and loudspeaker fields.

Very small, low-power amplifiers may be mounted on the projector, deriving their operating power from the main amplifying system.

Audio Research, Inc., 105-107 E. 16th St., New York City.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Electrical Research Products, 250 West 57th St., New York City.
Jensen Radio Manufacturing Company, 6601 S. Laramie Ave., Chicago, Ill.
Kansas City Sound Service Company, 130 W. 18th St., Kansas City, Mo.
Motiograph, Inc., 4431 W. Lake St., Chicago, Illinois.
National Theatre Supply Company, 92-96 Gold St., New York City.
RCA Manufacturing Company, Inc., Educational Department, Camden, N. J.
Safety Projector Company, 310 West 2nd St., Duluth, Minn.
The Magnavox Co., Inc., Fort Wayne, Ind.
Universal Microphone Company, Ltd., Centinela at Warren Lane, Inglewood, California.
Webster Electric Company, Racine, Wisconsin.

Microphones

There are many uses for microphones in schools: to speak through sound motion picture amplifiers and speakers; for sound recording; with centralized sound systems, etc. Microphones can be used with separate amplifying and loudspeaker equipment, or can be operated through the existing sound installation.

Audio Research, Inc., 105-107 E. 16th St., New York City.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Kansas City Sound Service Company, 130 W. 18th St., Kansas City, Mo.
Mellaphone Corporation, Rochester, N. Y.
National Theatre Supply Company, 92-96 Gold St., New York City.
Pacent Engineering Corporation, 79 Madison Ave., New York City.
RCA Manufacturing Company, Inc., Educational Dept., Camden, N. J.
Safety Projector Company, 310 West 2nd St., Duluth, Minn.
The Magnavox Co., Inc., Fort Wayne, Ind.
Universal Microphone Company, 424 Warren Lane, Inglewood, Cal.

Radio Receiving Sets

Crosley Radio Corporation, Cincinnati, Ohio.
Emerson Radio and Phonograph Corp., 111 Eighth Ave., New York City.
Galvin Mfg. Corporation, Chicago, Ill.
Philco Radio and Television Corp., Philadelphia, Pa.
RCA Manufacturing Company, Inc., Educational Department, Camden, N. J.
Stromberg-Carlson Tel. Mfg. Co., 100 Carlson Rd., Rochester, N. Y.
Zenith Radio Corp., 6001 W. Dickens, Chicago, Ill.

Public Address Systems

Electrical Research Products, 250 West 57th St., New York City.
Jensen Radio Manufacturing Company, 6601 S. Laramie Ave., Chicago, Ill.
Kansas City Sound Service Company, 130 W. 18th St., Kansas City, Mo.
National Theatre Supply Company, 92-96 Gold St., New York City.
Pacent Engineering Corporation, 79 Madison Ave., New York City.
RCA Manufacturing Company, Inc., Educational Dept., Camden, N. J.
Safety Projector Company, 310 West 2nd St., Duluth, Minn.
The Magnavox Co., Inc., Fort Wayne, Ind.
Universal Microphone Company, Ltd., Centinela at Warren Lane, Inglewood, California.

Phonographs and Record Players

Columbia Phonograph Corporation, New York, N. Y.
Emerson Radio and Phonograph Corporation, New York, N. Y.
Philco Radio and Television Corp., Philadelphia, Pa.
RCA Manufacturing Company, Inc., Educational Dept., Camden, N. J.
Sonora Electric Phonograph Co., New York, N. Y.
The Magnavox Co., Inc., Fort Wayne, Ind.

Audio-Visual Instruction Equipment

16-mm. Motion Picture Projectors (Sound)

Ampro Corporation, 2839 North Western Ave., Chicago, Illinois.
Bell & Howell Compaany, 1801 Larchmont Ave., Chicago, Illinois.
Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Holmes Projector Company, 1815 Orchard St., Chicago, Illinois.
RCA Manufacturing Company, Inc., Educational Department, Camden, N. J.

Victor Animatograph Company, Davenport, Iowa.
Weber Machine Corporation, 59 Rutter St., Rochester, New York.
Western Electric Company, 250 West 57th St., New York City.

35-mm. Motion Picture Projectors (Sound)

Herman A. DeVry, Inc., 1111 W. Armitage Ave., Chicago, Illinois.
Holmes Projector Company, 1815 Orchard St., Chicago, Illinois.
International Projector Corporation, 90 Gold St., New York City.
Motiograph, Inc., 4431 W. Lake St., Chicago, Illinois.
RCA Manufacturing Company, Inc., Educational Department, Camden, N. J.
Safety Projector & Film Company, Duluth, Minn.
Weber Machine Corporation, 59 Rutter St., Rochester, New York.
Western Electric Company, 250 West 57th St., New York City.

Sound-Slidefilm Units

Operadio Manufacturing Co., St. Charles, Ill.
RCA Manufacturing Company, Inc., Educational Department. Camden, N. J.
The Magnavox Co., Inc., Fort Wayne, Ind.
Webster Electric Co., Racine, Wisc.

Visual Publications

EDUCATIONAL SCREEN—Published monthly except July and August by The Educational Screen, Inc., 64 East Lake St., Chicago, Ill.
VISUAL REVIEW—Published annually by the Society for Visual Education, Inc., 100 East Ohio St., Chicago, Ill. (Free.)

NOTE: Those who may desire assistance in the selection of suitable equipment for the application of audio-visual aids to instruction will find the various extension divisions (see page 192) ready to assist. Furthermore, the loan service of visual aids available through extension divisions and university distributing centers is more reasonable in cost and more satisfactory than service selected at random.

Screen Image Table

For 35-mm. Filmstrips

The size of the screen image is governed by the Equivalent Focal Length of the lens and the distance the projector is placed from the screen.

The following table applies when **double frame** film is shown. This table shows the size of picture obtained on the screen with a given focal length lens at a given distance, using horizontal frames. The proportions are merely reversed when showing vertical frames, therefore square screens are recommended.

Equivalent Focal Length of Lens	DISTANCE FROM MACHINE TO SCREEN								
	10′	15′	20′	25′	30′	35′	40′	45′	50′
3″	3.0 4.6	4.5 6.8	6.0 9.0	7.6 11.4	9.1 13.6	10.5 15.8	12.1 18.2	13.6 20.4	14.9 22.4
4″	2.3 3.4	3.4 5.0	4.5 6.8	5.8 8.8	6.8 10.2	7.9 11.8	9 1 13.6	10.2 15.2	11.2 16 8
5″	1.8 2.6	2.7 4.0	3.6 5.4	4.6 7.0	5.4 8.0	6.4 9.6	7.3 11 0	8.2 12.4	9.0 13.6
6″	1.5 2.2	2.3 3.4	3.0 4.6	3 8 5.8	4.5 6.8	5.3 8.0	6.1 9.2	6.8 10.2	7.5 11.5
7″	1.3 1.9	1.9 2.9	2.6 3.9	3.3 4.9	3.9 5.9	4.5 6.8	5.2 7.8	5.8 8.7	6.4 9.6

The following screen images are obtained from **single frame** film at the same distances with given focal length lenses:

3″	2.3 3.0	3.4 4.5	4.5 6.0	5.7 7.6	6.8 9.1	7.9 10.5	9.1 12.1	10.2 13.6	11.2 14.9
4″	1.7 2.3	2.5 3.4	3.4 4.5	4.4 5.8	5.1 6.8	5.9 7.9	6.8 9.1	7.6 10.2	8.4 11.2
5″	1.3 1.8	2.0 2.7	2.7 3.6	3.5 4.6	4.0 5.4	4.8 6.4	5.5 7.3	6.2 8.2	6.8 9.0
6″	1.1 1.5	1.7 2.3	2.3 3.0	2.9 3.8	3.4 4.5	4.0 5.3	4.6 6.1	5.1 6.8	5.6 7.5

Short focal length lenses should be used when pictures are shown through translucent screens, but such screens are not recommended unless absolutely necessary.

For 16-mm. Motion Pictures

Equivalent Focal Length of Lens	DISTANCE FROM MACHINE TO SCREEN														
	8′	10′	12′	16′	20′	25′	32′	36′	40′	50′	64′	75′	100′	125′	150′
16 mm. Projector	WIDTH OF PICTURE														
5/8″	4′10″	6′0″	7′2″	9′7″	12′0″	..	. ...	.	. .	. ..	.... .	. ..	.. ..	.....	.....
3/4″	4′0″	5′0″	6′0″	8′0″	10′0″	12′6″	.....	....	. ...	.. .	.....	....	.....	.....	.....
1″	3′0″	3′9″	4′6″	6′0″	7′6″	9′4″	11′11″	13′5″	14′11″	...	... ..	....	...	.. .	....
1½″	2′0″	2′6″	3′0″	4′0″	5′0″	6′3″	8′0″	9′0″	10′0″	12′6″	... ..	.....	.....	.....	.....
2″	1′6″	1′10″	2′3″	3′0″	3′9″	4′8″	6′0″	6′9″	7′5″	9′4″	11′11″	14′0″	18′9″	23′5″	28′1″
2½″	1′2″	1′6″	1′9″	2′4″	3′0″	3′9″	4′9″	5′4″	6′0″	7′6″	9′7″	11′3″	15′0″	19′3″	22′5″
3″	.....	1′3″	1′6″	2′0″	2′6″	3′1″	4′0″	4′6″	5′0″	6′3″	8′0″	9′4″	12′6″	15′7″	18′8″
3½″	....	1′0″	1′3″	1′8″	2′1″	2′8″	3′5″	3′10″	4′3″	5′4″	6′11″	8′0″	10′8″	13′4″	16′0″
4″	...	...	1′1″	1′6″	1′10″	2′4″	3′0″	3′3″	3′9″	4′8″	6′0″	7′0″	9′4″	11′8″	14′0″

For Lantern Slides, 2¾x3-inch Mat Opening

Equivalent Focal Length of Lens	DISTANCE FROM MACHINE TO SCREEN												
	15′	20′	25′	30′	35′	40′	45′	50′	60′	70′	80′	90′	100′
6″	7½	10	12½	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8″	5½	7½	9½	11¼	13	15	....	....	.....	....	.....	.....	.....
10″	4½	6	7½	9	10½	12	13½	... ..	... ..	.....	.....	.....	.....
12″	.....	5	6¼	7½	8¾	10	11¼	12½	15	.....	.....	.....	.....
15″	.....	4	5	6	7	8	9	10	12	14	16½	.....	.....
18″	.....	.....	.....	5	5¾	6½	7½	8¼	10	11½	13	15	16½
20″	.....	.....	.....	4¼	5	5¾	6½	7¼	8¾	10¼	11¾	13¼	14¾
22″	... ..	.....	.....	.....	.....	5¼	5¾	6½	8	9¼	10½	12	13¼
24″	.....	.....	.....	.....	.....	4¾	5¼	6	7¼	8½	9¾	11	12¼

Example—A 10-inch lens used at a distance of 40 feet from the screen will project an image measuring 12 feet on its longer side